Guidance on the provision of anaesthesia services for Trauma and Orthopaedic Surgery

When considering the provision of anaesthesia, the Royal College of Anaesthetists recommends that the following areas should be addressed. The goal is to ensure a comprehensive, quality service dedicated to the care of patients and to the education and professional development of staff. The provision of adequate funding to provide the services described should be considered.

Summary

- There should be appropriately staffed and equipped operating theatres and an imaging suite immediately available for injured patients who need life-saving interventions.[1,2]
- All hospitals that receive acutely injured patients should have a defined response to major trauma that includes the prompt assembly of a multidisciplinary trauma team in the emergency department. An anaesthetist with sufficient skills and training to deal with major trauma should be involved in the immediate management of such cases.[2,3]
- Trained assistance must be available for the anaesthetist in all locations where anaesthesia is conducted, including the Emergency Department and the imaging suite, as well as in the operating theatre.[4]
- Children undergoing surgical care require all facilities and staffing that would be expected in any paediatric unit.[3,5–7] Members of the anaesthesia team conducting anaesthesia for children must be trained and skilled in paediatric anaesthesia and resuscitation.[3]
- Specialised equipment for difficult airways must be readily available in all areas where trauma patients are anaesthetised. Anaesthetists and assistants providing anaesthesia for these patients must be competent in difficult airway management.[4,8,9]
- Patients with fractures of the femoral neck should normally have these surgically corrected within 24 hours of admission to hospital. A system should be in place to 'fast-track' them from the emergency department through other areas to theatre. Pre-operative assessment and optimisation should be a priority but not delay surgery. Experienced anaesthetists and orthogeriatricians should work together to ensure delays do not occur.[10,11]
- Flexible management of trauma lists, exclusive daytime trauma lists or additional evening and weekend sessions in dedicated, fully staffed and suitably equipped operating theatres will improve efficiency of dealing with trauma during the normal working day and reduce the need to operate out-of-hours.[12,13]
- Healthcare providers have responsibilities to ensure the health and safety of their employees and others and to control and manage the risk of infection, blood spray and exposure to radiation.[14]

Introduction: The importance of anaesthesia services for trauma and orthopaedic surgery

- Trauma and orthopaedic surgery encompasses a wide range of emergency and elective work in patients of all ages presenting with minor injuries, congenital abnormalities, high-energy trauma, fractures in the elderly due to falls or fragility, or degenerative joint conditions.
- Immediate, life-saving surgery may be needed for trauma patients. Others need operations within a few hours to meet standards associated with an improved outcome. Many can be scheduled for the next available list or next day.
- Prompt surgical intervention in stable patients can reduce their length of stay.
- Most patients requiring surgery for trauma are admitted through the emergency department.
- General anaesthesia is essential for many orthopaedic procedures. Some limb surgery can be performed under regional or local anaesthesia but still requires the presence of a competent anaesthetist.

Fractured neck of femur surgery

- Fractured neck of femur is the most common condition requiring emergency orthopaedic surgery in the UK. Most patients are aged over 65 years. Many elderly patients have co-existing illnesses and confusional states that may need pre-operative assessment or treatment by physicians, as well as anaesthetists. The 30-day mortality is over 10%.
- Pre-operative treatment must be timely and realistic. Prolonged delays increase the risk of chest infections in those who are immobile after injury. Early surgery helps to provide pain relief and promote mobilisation. Efficient planning and running of operating lists are of critical importance in avoiding delay.

Major trauma

- General anaesthesia is usually necessary for emergency operations for major trauma.
- Airway and ventilatory support is often required in the initial management of a severely injured patient in the emergency department and requires competent anaesthetists, anaesthetic assistance and appropriate equipment.
- There is a high incidence of airway management difficulties requiring difficult airway equipment due to actual or suspected cervical spine injury.
- Some patients need emergency operations within an hour. These include:
  - life-threatening pelvic injuries
  - major traumatic amputation
  - multiple injuries requiring damage control surgery
  - fractures, dislocations or soft tissue injuries with vascular compromise or continuing bleeding
  - heavily-contaminated open fractures
  - compartment syndrome.
- Other conditions will require operations within a few hours, e.g. open fracture (within six hours) and fractures, dislocations or soft tissue injuries with potential vascular compromise or high analgesia requirements.
- Immediate, abbreviated, life-saving surgery may be necessary to control bleeding and prevent further contamination. Simultaneous surgery may be required for separate injuries to limit operative time. Senior anaesthetic involvement is essential.
- A high index of suspicion of other life-threatening injuries must be maintained when treating patients with serious bony injuries. Multidisciplinary care is an essential pre-requisite at all stages of their treatment.
- Many patients presenting after major trauma require intra-transfer to the operating theatre, to radiology suites (for further investigation or haemostasis by embolisation) or to the critical care unit. Inter-hospital transfer to other specialist units may also be required (e.g. neurosurgical or cardiothoracic units for patients with serious head or intra-thoracic great vessel injuries). Trained anaesthetic staff, assistance and equipment are essential in the provision of these services.
- Specific training in skills required for anaesthesia for emergency surgery and trauma is essential for all consultant anaesthetists and anaesthetic trainees working in this area.

Joint replacement surgery

- Patients undergoing major joint replacement are often elderly, with co-existing medical conditions and are prone to deep venous thrombosis. This can make anaesthesia more difficult, requiring experienced anaesthetic input.
- As the life expectancy of the population increases, more patients present for revision of major joint replacements. These operations are more difficult

than primary joint replacement, take longer and are associated with greater blood loss. Appropriate planning for such cases is essential for a successful outcome.

Levels of provision of service

1 Staffing requirements

1.1 Anaesthesia for trauma and orthopaedic surgery should be consultant led. All regular sessions should have a named anaesthetist assigned who is skilled and experienced in the provision of this service. When the assigned anaesthetist is not a consultant, there must be unimpeded access to a consultant anaesthetist.

1.2 The definitive care of complex spinal and pelvic injuries requires specialist spinal (orthopaedic or neurosurgical) and pelvic surgery. The anaesthetist managing such cases should have undergone training in the management of these cases and their associated complications.

1.3 Trained anaesthetic assistance must be present at all times in all clinical areas where anaesthetics are administered, including the emergency and radiology departments.[1]

1.4 In hospitals receiving patients with major injury and trauma, there must be adequate levels of appropriately experienced medical and non-medical staff to provide a 24-hour emergency service.

1.5 The reception of major trauma patients in the emergency department should be provided by a multidisciplinary team, including an anaesthetist sufficiently trained to deal with airway management of the trauma patient.

1.6 In hospitals in which trainee anaesthetists work a full or partial shift system, consideration should be given to providing additional consultant programmed activities to allow training and supervision to take place in the evening.

1.7 Patients presenting to district general hospitals with trauma may need transfer to a tertiary referral centre. An anaesthetist trained in inter-hospital transfer of severely injured, anaesthetised and ventilated patients will be necessary. The provision of this anaesthetist may impact on remaining anaesthetic human resources in the hospital. Sufficient team members should be available and mobilised to ensure that safe provision of emergency anaesthesia can be maintained within the hospital.

1.8 There must always be adequate numbers of staff to ensure safe transfer and positioning of anaesthetised patients, both at the start and end of surgery and anaesthesia.

2 Equipment, support services and facilities

Operating theatre equipment

2.1 Major joint replacements and surgery involving bone implants or internal fixation should be carried out in an operating theatre with a laminar air flow system to reduce risks of wound infection. Other infection control systems should be supported by the whole operating team.

2.2 There must be adequate protection from blood spray for all working in the operating theatre.

2.3 An appropriate range of equipment should be available for the safe positioning and transfer of patients. Staff should be trained in the correct use of such equipment.

2.4 Reliable, well-maintained tourniquets and inflation devices of suitable sizes should be available for upper and lower limb surgery requiring a bloodless field.

2.5 Warming devices for patients should be readily available for use in the anaesthetic room, operating theatre, recovery unit and emergency department.

2.6 A high-performance, blood warming system with a ready supply of disposables should be rapidly available to allow rapid infusion of blood and fluids.

2.7 A cell salvage system with a ready supply of disposables and staff trained in its use should be available for major trauma with ongoing haemorrhage and for other patients undergoing orthopaedic procedures associated with a risk of life-threatening blood loss.

Facilities

2.8 Hospitals that receive patients with major trauma should have an emergency operating theatre situated sufficiently close to the emergency department to allow rapid transfer.

2.9 The facility for the rapid estimation of haemoglobin, arterial blood gases and blood sugar should be available during surgery for patients with major trauma and those undergoing orthopaedic procedures associated with a risk of major haemorrhage.

2.10 Group O rhesus negative blood should be available in or adjacent to the theatre suite at all

times for emergency use. Type-specific and fully cross-matched blood should be made available to the operating theatre within 20 and 50 minutes respectively of an appropriate request. Other transfusion products to improve coagulation should be available rapidly when indicated according to a locally agreed protocol. In the dynamic situation of major haemorrhage, it is appropriate to administer such products using senior clinical judgement or agreed clinical guidelines before laboratory confirmation of abnormal coagulation.

2.11 There must be 24-hour access to a fully-staffed and equipped post-anaesthesia care unit (recovery unit) including the facility for invasive haemodynamic monitoring.

Critical care services

2.12 Hospitals admitting patients with major trauma should have a high dependency unit (HDU) of Level 2 standard and ICU of Level 3 standard on site. Portable invasive haemodynamic monitoring must be available to facilitate transfer to and from the critical care areas.

2.13 A fully-equipped HDU of Level 2 standard should be available on site for high-risk patients undergoing major orthopaedic surgery. If the hospital does not have a Level 3 facility, protocols should be in place to advise as to when and how transfer to a Level 3 facility should be expedited.

Imaging requirements

2.14 Hospitals admitting patients with major trauma should have 24-hour availability of plain radiography, CT scanning and angiography within or close to the emergency department. Radiographers for plain films should be immediately available at all times. CT radiographers and a radiologist skilled in CT interpretation should be available within 30 minutes of the patient's arrival in hospital. An appropriately trained interventional radiologist should be rapidly available to undertake embolisation or other radiological interventions within one hour of the patient's arrival.

2.15 An ultrasound scanner and a radiologist or other trained operator must be available to perform a focused assessment of the chest and abdomen in the resuscitation room 24 hours a day to exclude or confirm significant blood in the peritoneum, pericardium and pleural cavities.

2.16 Magnetic resonance imaging (MRI) should be available in all hospitals receiving patients with major trauma. Patients with unstable spinal fractures, dislocations and subluxations, with fractures through the foramen transversarium, or with clinical or radiological evidence of spinal cord or nerve root injury, should undergo prompt MRI scanning. Where there is evidence of serious nerve or nerve root compression, the MRI should be performed within four hours.

2.17 Trained radiographers and an image intensifier with facilities for producing plain films should be available in the operating theatre 24 hours a day for trauma and orthopaedic surgery.

2.18 A computerised image system should be in place, with viewing facilities in the operating theatre, recovery, critical care areas and wards.

2.19 Radiation protection screens or gowns and collars for thyroid protection must be available for all staff remaining in the operating room or imaging suite when radiographs are taken, an image-intensifier is used or a CT scan is performed.

2.20 Imaging suites receiving patients with major trauma should be equipped as a critical care environment. They should be situated sufficiently close to the emergency operating theatre to allow rapid transfer there when indicated.

Difficult airway management

2.21 A 'difficult intubation trolley' with a variety of laryngoscopes, tracheal tubes, laryngeal masks, and other aids for airway management must be available in all areas where major trauma patients may be received, including the emergency department.

2.22 Equipment for fibre-optic intubation for patients with potentially difficult airways, should be available. For elective use, intubating bronchoscopes should be fully and recently sterilised according to infection control standards. For appropriate emergency use, the time lapsed since the last sterilisation may be extended.

Local anaesthesia and analgesia

2.23 An acute pain service should be available for advice on and delivery of post-operative pain relief.

2.24 Patient controlled analgesia equipment and infusion devices must be available for post-operative pain relief.

2.25 An appropriate nerve stimulator and an ultrasound scanner with a probe for visualising vessels, nerves and other structures to facilitate regional nerve blocks should be available.

2.26 Reliable, well-maintained, double-cuff tourniquets should be available if intravenous regional anaesthesia (IVRA) is used.

2.27 A supply of sterile pre-mixed solutions of low-concentration local anaesthetic drugs, alone and in combination with opioids, should be available for use in continuous regional anaesthetic techniques, as well as other opioid solutions for use in patient-controlled analgesia devices.

2.28 There should be clear guidance on whom to call for problems with post-operative pain relief. There should be a locally-agreed regional analgesia record and a protocol for the prescription and administration of epidural drugs and training needed to manage epidurals on the ward.

Guidelines

2.29 There should be clear, written guidelines regarding the management of haemodynamically unstable patients, including immediate treatment in the emergency department, imaging suite or operating theatre and ongoing care after immediate interventions.

2.30 Other guidelines that should be in place include:

- management of patients with suspected or diagnosed spinal injuries, including lifting and handling, immobilisation and clearance of injuries
- the management of failed difficult intubation
- the management of major haemorrhage
- prevention of thrombo-embolic events post-operatively
- the management of regional techniques in relation to thrombo prophylaxis
- the management of high regional block, failed regional block, accidental dural puncture and post-dural puncture headache
- the management of patients known to be taking anti-platelet drugs.

3 Areas of special requirement

3.1 Patients requiring surgery within the hour require interruption of a current list or the availability of a dedicated operating theatre.

3.2 Acute nerve or spinal cord compression requires immediate referral to a neurosurgeon or specialist spinal surgeon and facilities to expedite safe transfer.

Jehovah's Witnesses

3.3 In elective orthopaedic surgery where heavy blood loss is anticipated, specific measures should be considered in patients who are Jehovah's Witnesses, including re-infusion of post-operatively drained blood or cell salvage. All options must be discussed with the patient first if possible. Such patients should be operated on and anaesthetised by senior and experienced members of surgical and anaesthetic staff.[15]

Children

3.4 Children presenting for orthopaedic or trauma surgery must have access to appropriate facilities, staff and equipment.[5]

4 Training and education

4.1 Anaesthetists and surgeons who manage patients with major trauma should undertake advanced trauma life support (ATLS) or equivalent training. Those who continue to practise should continue to update this training at regular intervals.

4.2 All anaesthetists providing anaesthesia for trauma or orthopaedic surgery should have the knowledge, skills, attitudes and behaviour in accordance with the Royal College of Anaesthetists training standards.[3,16,17]

4.3 Consultant anaesthetists responsible for the intra-operative anaesthetic care of patients with major trauma must maintain their skills and be up to date with current recommendations.

4.4 Specific skills, drills and scenario training for the initial management of major trauma care should be regularly conducted for all members of the trauma and theatre team.

4.5 Major incident training exercises should take place at regular intervals.

4.6 Where a service is being provided for children, all of the anaesthesia team members must have regularly updated training (appropriate to their roles) in paediatric anaesthesia and resuscitation.

4.7 Staff in the recovery area and in the wards who receive patients after surgery with epidural infusions, nerve blocks or intravenous opioid infusions (including PCA) should have received formal training in caring for these forms of analgesia.

4.8 Trauma theatre teams should be trained in the correct use of all essential theatre equipment for trauma surgery and anaesthesia, including tourniquets, high-performance blood warming systems and cell-savers.

4.9 Medical staff undertaking IVRA should be trained in the technique and in the correct use of local anaesthetic agents including dose limits and in resuscitation.

4.10 Nurses expected to care for patients with epidurals *in situ* should be trained to local guidelines before they top up epidurals or look after such patients.

5 Research and audit

5.1 Research in anaesthesia for trauma and orthopaedic surgery should be encouraged and time set aside for this activity.

5.2 Trauma and orthopaedic surgery should be included in anaesthetic departmental audit programmes, including ongoing audit of complications and adverse events.

5.3 A range of specific quality indicators should be developed, such as:

- time to operation, length of stay and mortality in patients with fractures of the femoral neck
- wound infection rates and the incidence of MRSA in all surgical cases
- blood and blood product usage.

5.4 All hospitals that receive patients with major trauma should subscribe to the Trauma Audit and Research Network (TARN).

5.5 De-anonymised comparative data analysis is invaluable for quality assurance and has been endorsed by the Healthcare Commission.

6 Organisation and administration

Fractured neck of femur service

6.1 Patients with a fracture of the femoral neck should normally have surgical correction within 24 hours of admission to hospital. A system should be in place to 'fast-track' them from the emergency department through other areas and to theatre. They should receive prompt, appropriate pain relief and fluid resuscitation and standardised pre-operative investigations according to locally agreed protocols.

Emergency orthopaedics and trauma

Hospitals receiving patients with major trauma should have the following organisational arrangements.

6.2 There should be a defined agreement for immediate or urgent access to an operating theatre with appropriately trained and experienced staff to provide rapid intervention in life-threatening/limb-threatening conditions. Less urgent cases will require the trauma list to be interrupted between cases or a separate theatre to be opened and staffed. A flexible approach to emergency theatre list planning and management is required.

6.3 Theatre teams should be informed whenever a patient who is unstable with major trauma is expected, has arrived or has been identified in the emergency department. A member of the theatre team should have responsibility for ensuring the availability of appropriately trained staff and facilities.

6.4 There must be a defined response in the call-out of a multidisciplinary trauma team led by a defined trauma team leader. All medical team members should be trained in ATLS or its equivalent.

6.5 Protocols must be established to ensure that any surgical specialties not on site (e.g. vascular or plastic surgery) can be contacted efficiently without undue delay.

6.6 A clear line of communication from the duty anaesthetist to the on-call consultant should be assured at all times. Any conflict of priorities should be referred to senior staff.

6.7 Consultants in anaesthesia and intensive care must be involved in the planning of local trauma services.

6.8 Trauma operating lists should take place on a daily basis in working hours to prevent a backlog that results in unnecessary overnight operations. The provision of extra trauma lists in the evenings and at weekends further helps to prevent patients requiring surgery late at night.[13]

6.9 All acute hospitals should have a defined major incident plan that complies with current recommendations. This should cover the call-in of extra staff and the assignment of specific roles.

6.10 Joint orthopaedic-anaesthetic trauma audit meetings should take place to evaluate compliance with defined standards, to discuss morbidity and mortality, and to feed back information from TARN.

Elective orthopaedics

6.11 Elective orthopaedic operating lists should be separated from those for traumatic orthopaedic surgery to allow efficient planning in advance for elective cases, prevent cancellation of planned cases and allow a flexible response for emergencies.

6.12 There should be a pre-operative assessment clinic for elective orthopaedic surgery. There should be an agreed list of conditions that require pre-admission assessment by an anaesthetist and a defined mechanism to ensure that patients with these conditions are referred.

7 Patient information

Patients with difficult airways

7.1 When an awake fibre-optic intubation is required, it is important to fully inform the patient of what to expect.

7.2 As part of a 'difficult airway follow-up', patients should be informed about any airway problem the anaesthetist has encountered and be advised to highlight this problem in any future pre-operative assessment.

Regional anaesthetic techniques

7.3 When a regional anaesthetic technique is planned on an awake patient, it important to fully inform the patient of what to expect. The potential complications and the risk in relation to the benefits of the technique should be explained and documented in the patient's notes.

Informed consent and the confused patient

7.4 Informed consent may be impossible for many patients undergoing trauma and fractured neck of femur surgery due to confusion, dementia, altered conscious level, severe pain or the effects of sedative drugs. Patients should not be asked to sign a consent form if they are not competent so to do and a 'two doctor' consent process should be used if urgent surgery is in the patient's best interests. A high level of integrity must be maintained, and good documentation is essential.

Death and dying

7.5 Major trauma results in a sudden loss of health, disability and a risk of dying. Communicating with the patients and their families is essential. On occasions, explanations and detailed discussion may need to be deferred or delegated to others so that emergency treatment can proceed without delay. Breaking bad news to close relatives in the event of a death occurring should be undertaken by senior medical and nursing staff in appropriate surroundings as soon as is feasible. Follow-up arrangements should be offered.

7.6 When it is considered appropriate for an order not to attempt resuscitation in the event of a cardio-respiratory arrest (DNAR) it must be discussed with competent patients, including those who have expressed their own wish not to be resuscitated (e.g. living wills). in patients incompetent to consent, every attempt should be made to discuss this with the close family (or an Independent Mental Capacity Advocate), according to local trust guidelines.

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