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. These recommendations form the basis of the standard expected for departmental accreditation.
**Summary**

- There should be appropriately staffed and equipped operating theatres and a hybrid care suite for radiological or surgical interventions immediately available for injured patients who need life-saving interventions.\(^1\)\(^2\)\(^3\)

- All major trauma centres (MTCs) and trauma units (TUs) 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 appropriate skills and training to deal with major trauma should be involved in the immediate management of such cases.\(^1\)\(^2\)

- Anaesthetists have an important role to play in pre-hospital care, as members of enhanced care teams,\(^2\)\(^4\) treating patients at the scene and transferring them to or between hospitals. Anaesthetic departments in MTCs (and TUs) should support this role in a limited number of individuals.

- 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.\(^5\)

- Children undergoing surgical care require all the facilities and staffing required for paediatric practice.\(^6\)\(^7\) Members of the team conducting anaesthesia for children must be trained and skilled in paediatric anaesthesia and resuscitation.

- 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.

- Patients with hip fractures should normally have these surgically corrected within 24 hours of admission to hospital.\(^8\)\(^9\)\(^10\) 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, to prevent delay in surgery. Experienced anaesthetists and orthogeriatricians should work together to ensure delays do not occur.

- 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 the efficiency of dealing with trauma during the normal working day and reduce the need to operate out of hours.\(^11\)\(^12\)

- 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.
Introduction: the importance of anaesthesia services for trauma and orthopaedic surgery

- Trauma and orthopaedic surgery encompass 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.

Hip fracture surgery

- Hip fracture 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 need pre-operative assessment and treatment by orthogeriatricians, as well as anaesthetists. The 30-day mortality remains high.
- 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. The entire pathway should be managed within a formal hip fracture programme.

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 difficulty, requiring difficult airway equipment, owing to direct or indirect trauma to the airway, bleeding into or soiling of the airway, and actual or suspected cervical spine injury.
- Immediate, abbreviated, life-saving surgery may be necessary to control major bleeding and deal with contamination from disruption of internal organs. 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 bone injuries. Multidisciplinary care is an essential pre-requisite at all stages of their treatment.
- Some major trauma patients require anaesthetic skills in the field. Anaesthetists have an important role on pre-hospital enhanced care teams, treating patients at the scene and transporting them to hospital or between hospitals. Many will broaden their training within the new specialty of pre-hospital emergency medicine.
- While enhanced care teams are increasingly carrying out inter-hospital transfer from trauma units (TUs) to major trauma centres (MTCs), there will be occasions when transfer must be provided by the initial receiving hospital. Trained anaesthetic staff, assistance and equipment are essential in the provision of such transfers.

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.

Orthopaedic surgery in children

- Children requiring orthopaedic surgery have underlying congenital or acquired conditions that may prove challenging. Neurological conditions may be associated with difficulty in communication and positioning. Such children may be more susceptible to the sedative effects of anaesthetic agents and prone to aspiration. Other children may have anatomical abnormalities that affect the airway and breathing, for example kyphoscoliosis.
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 for advice and a pre-defined means of providing immediate assistance in the event of an unexpected acute problem. There should be a named consultant who is responsible for a trainee who is managing a case without direct supervision. The pre-assessment service for elective patients should also be consultant led.

1.2 In MTCs, there should be a consultant in trauma resuscitation and anaesthesia (or other consultant anaesthetist with ongoing training and experience in major trauma care) who is free to attend major trauma calls in the emergency department. This role may be combined with other responsibilities that can be deferred in the event of a trauma call, e.g. managing planned access to the emergency operating theatre, providing advice and immediate (but not continuing) assistance to trainee anaesthetists, and reviewing analgesia and physiological stability in recently admitted major trauma patients.

1.3 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.

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

1.5 The use of intravenous and inhalational agents to provide analgesia and sedation for procedures undertaken in the emergency department (e.g. manipulation and reduction of fractures and dislocations or simple wound management) must be managed according to guidance from the Royal College of Anaesthetists and the Royal College of Emergency Medicine. Similar requirements apply in other settings outside the operating theatre and when using other routes of administration (e.g. intranasal). Careful monitoring of cardiorespiratory function and conscious level is essential. Appropriate assistance must be available, especially when using intravenous anaesthetic agents in sedative doses. Anaesthetists in training and non-anaesthetists administering the sedation-analgesia without direct supervision must have been assessed as competent in this skill.

1.6 Theatre staff should be available who are appropriately skilled and experienced in the various surgical subspecialty procedures required in patients with multiple injuries.

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

1.8 A pre-hospital care team that includes medical personnel (level 6–8 accredited practitioners) with anaesthetic skills should be available constantly to provide direct pre-hospital care to the major trauma patient. The enhanced care team may attend the scene by land or by helicopter and accompany severely injured patients to the receiving hospital and transfer them between hospitals.

1.9 Anaesthetists who provide pre-hospital care in the field should be accredited to do so. Many anaesthetists will broaden their training within the new specialty of pre-hospital emergency medicine. Anaesthetic departments in MTCs and TUs should appoint consultants with an interest in pre-hospital care.

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

1.11 The reception of major trauma patients in the emergency department of an MTC or TU should be provided 24/7 by a multidisciplinary team, including an anaesthetist of ST4 level or above and sufficiently trained to deal with airway problems and initiate damage-control resuscitation of the trauma patient. MTCs, should look to provide consultants in trauma resuscitation and anaesthesia to attend major trauma calls 24/7.
1.12 The management of critically injured patients should be consultant delivered. Anaesthesia for the emergency control of major traumatic haemorrhage, and other damage-limiting interventions in the operating theatre or radiology intervention suite, should be provided by a consultant anaesthetist.

1.13 Trauma patients presenting to a TU, or inadvertently to a local emergency hospital that is not accredited to receive major trauma patients, may need to transfer to a tertiary referral centre. Enhanced care teams should become the principal escorts for secondary transfer to an MTC. However, TUs must maintain the capability to transfer major trauma patients safely in time-limited situations, as the enhanced care team may be committed elsewhere and not available immediately. When a team from the initial hospital transfers a patient, arrangements should be in place to provide safe management of ongoing clinical problems while they are absent.

1.14 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.

2 Equipment, support services and facilities

Operating theatre equipment

2.1 There should be an emergency operating theatre that is rapidly available at all times for life-saving surgery in major trauma patients. The available equipment should be suitable for a full range of emergency procedures in major trauma patients. Use of this theatre for non-immediate cases must be tightly controlled, so that it can be made available promptly. If the theatre is occupied by an ongoing immediate emergency case, there should be a constantly updated backup plan to obtain an appropriate alternative theatre for a further immediate emergency case.

2.2 In addition to an emergency theatre, there should be a rapidly accessible imaging suite for interventional radiology to control haemorrhage. This should be a hybrid care suite that allows a full range of surgical interventions as well as radiological assessment and intervention. This should allow resuscitation with angiography, percutaneous techniques and operative repair, including arterial embolisation, balloon catheter tamponade and temporary intravascular shunts.3

2.3 Major joint replacements and surgery involving bone implants or internal fixation should be carried out in an operating theatre with multiple air changes per hour (not necessarily laminar flow) to reduce the risks of wound infection. Other infection-control systems should be supported by the whole operating team.

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

2.5 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. Hospitals receiving major trauma patients must have a trauma theatre equipped with a radiolucent operating table that allows fluoroscopic imaging of all body parts without repositioning the patient. This should be an operating table specifically designed for spinal, thoracic, pelvic and lower limb trauma.

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

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

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

2.9 A cell salvage system,19,20 using a centrifuge device or a simpler ultrafiltration device, 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

2.10 In MTCs and TUs, the resuscitation room receiving bays should be large enough to allow simultaneous emergency procedures by trauma team members. Equipment for a wide range of procedures, including difficult intubation, chest decompression and drainage, and immediate thoracotomy, should be immediately available.

2.11 Hospitals that receive patients with major trauma should have an emergency operating theatre and a radiology intervention suite situated sufficiently close to the emergency department to allow rapid transfer.

2.12 Near-patient testing for haemoglobin, arterial blood gases, lactate, calcium, potassium 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.

2.13 Group O Rhesus-negative blood should be available in or adjacent to the theatre suite at all times for emergency use. For certain patients, including men, and women beyond child bearing age, O Rhesus-positive blood may be appropriate if O Rhesus-negative blood is in short supply; this should be determined by local transfusion committees. Type-specific and fully cross-matched blood should be made available to the operating theatre within 15 and 40 minutes respectively of an appropriate request. There should be a defined policy for providing a series of ‘shock packs’ containing blood, plasma and platelets in appropriate proportions for patients with major ongoing bleeding.21,22,23 In MTCs and other large acute hospitals with a high turnover of plasma supplies, pre-thawed plasma should be immediately available, to avoid the delay of thawing fresh-frozen plasma. Alternative plasma preparations that do not require thawing may become available in the near future.

2.14 Other transfusion products to improve coagulation should be available rapidly when indicated, according to a locally agreed major haemorrhage protocol.21 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. In complex situations, there should be rapid access to advice from a consultant haematologist.

2.15 Tranexamic acid should be available for administration if major haemorrhage is suspected in a trauma patient within three hours of injury.24

2.16 There must be 24-hour access to a fully-staffed and equipped post-anaesthesia care unit (PACU)25 with facilities for invasive haemodynamic monitoring.

2.17 Patients undergoing emergency laparotomy for trauma (or other emergency conditions), who do not require a critical care unit bed, should go to a level-1 bed on an acute ward or be managed in an extended PACU facility.26 Patients undergoing long or complex elective orthopaedic procedures, particularly in those with pre-existing health problems, should also be able to go to a level-1 bed or stay in an extended PACU to optimise care before returning to a level-0 ward bed. Selected hip fracture patients may benefit from similar post-operative arrangements.

Critical care services

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

2.19 A fully-equipped HDU of level 2 standard should be available on site for high-risk patients undergoing major orthopaedic surgery, including revision joint replacement and surgery involving instrumentation of the spine. If the hospital does not have a level 3 facility, protocols should be in place to determine when and how to transfer to a hospital with a level 3 facility.

2.20 Critical care outreach services provide a vital link between trauma and orthopaedic wards and ICU facilities. Clinical deterioration can be identified using early-warning scores and mitigated by proactively reviewing patients at risk.
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Imaging requirements

2.21 Hospitals admitting patients with major trauma should have 24-hour availability of plain radiography, computed tomography (CT) scanning and interventional radiology, within or close to the emergency department. Radiographers for plain films should be immediately available at all times.

2.22 Hospitals admitting children with major trauma should follow the imaging guidance produced by the Royal College of Radiologists, to ensure appropriate imaging and to reduce radiation exposure.\(^{27}\)

2.23 CT radiographers and a radiologist skilled in CT interpretation should be available within 30 minutes of the patient’s arrival in hospital. CT scanning is the primary imaging modality for severely injured patients.\(^{28}\)

2.24 An appropriately trained interventional radiologist should be rapidly available, to undertake embolisation or other radiological interventions to treat or prevent major haemorrhage within one hour of the patient’s arrival in an MTC.

2.25 An ultrasound scanner and a radiologist, or other trained operator, should be available at all times to assess for and monitor bleeding into the peritoneal and pleural cavities and the pericardium. However, the use of ultrasound in the resuscitation room must not delay CT scanning, which has succeeded it as a primary imaging modality.

2.26 Ultrasound machines for trans-thoracic and trans-oesophageal echocardiography, and a cardiologist or other trained operator, should be available at all times to assess suspected injuries to the heart in major trauma cases and worsening myocardial dysfunction in elective or emergency cases.

2.27 Magnetic resonance imaging (MRI) is the investigation of choice for spinal cord injury.\(^{2,28}\) Patients with unstable spinal fractures, dislocations and subluxations, or with suspected spinal cord or nerve root injury should undergo prompt MRI scanning.

2.28 An MRI scanner must be available 24 hours a day in MTCs.\(^{2,28}\) Specialist anaesthetic equipment should be available that is compatible with strong magnetic fields. TUs should also have an MRI scanner. Remote TUs should look to provide an MRI service out of hours, to optimise decisions on patient transfer to MTCs.

2.29 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. All trauma lists should have the provision of a dedicated radiographer for the session and availability of a radiographer for out-of-hours cases. There should be clear planning for the provision of a radiographer for elective orthopaedic operating sessions when intra-operative imaging is required.

2.30 A computerised imaging system should be in place, with viewing facilities in the emergency department, operating theatre, recovery room, critical care areas and acute wards.

2.31 Radiation-protection screens or gowns and collars for thyroid protection must be worn by 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.

2.32 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

2.33 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.

2.34 Equipment for fibreoptic intubation for patients with potentially difficult airways should be available. Intubating bronchoscopes should be adequately and recently sterilised according to standards of infection control.\(^{29}\)
Local anaesthesia and analgesia

2.35 Anaesthetists who provide anaesthesia for elective and emergency orthopaedic surgery should be competent in a wide range of local anaesthetic techniques, including central and peripheral neural blockade. Ultrasound devices should be used to facilitate safe, accurate needle and catheter placement.

2.36 An acute pain service should be available for advice on and delivery of post-operative pain relief. The service must be competent in the ongoing management of local anaesthetic and analgesic infusions through epidural and perineural catheters.

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

2.38 An ultrasound scanner with a probe for visualising vessels, nerves and other structures, to facilitate regional nerve blocks, should be available, whenever they are performed. A nerve stimulator should also be available.

2.39 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.

2.40 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

2.41 There should agreed clinical guidelines for the management of emergency anaesthesia within the emergency department, and for emergency surgical airway and resuscitative thoracotomy.

2.42 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 the emergency interventions. The use of adjuncts, such as tourniquets and pelvic binders, and the key treatment options of immediate surgery and interventional radiology, should be addressed within the policy.

2.43 There should be a major haemorrhage protocol to cover the use of blood and blood products in appropriate proportions in a series of ‘shock packs’ and to give guidance on laboratory and near-patient monitoring, permissive hypotension and damage-control resuscitation. In MTCs and in other large acute hospitals, pre-thawed plasma should be immediately available with the initial shock pack.

2.44 Tranexamic acid should be administered to patients when evidence of serious haemorrhage is identified within three hours of injury.

2.45 In the management of major haemorrhage, due consideration should be given to the concept of permissive hypotension and to the use of small increments of fentanyl in combination with judicious administration of blood or blood product. During damage-control resuscitation with uncontrolled bleeding, blood and blood products should be administered rather than crystalloids or non-blood-product colloids.

2.46 There should be clear guidelines for the management of patients on anticoagulation medication in trauma cases and in patients undergoing elective or other emergency orthopaedic surgery. These should include specific guidance on managing patients with cardiac stents and those on newer anticoagulants with no defined reversal agents. If major haemorrhage is suspected in patients on warfarin (or a similar drug), the anticoagulation effect should be reversed promptly with prothrombin complex concentrate, without waiting for laboratory results.

2.47 There should be a policy for the prevention of thromboembolic events postoperatively. Patients undergoing pelvic surgery are at particular risk. Anticoagulant prophylaxis may be deferred in patients who are vulnerable to further bleeding, but it is important to plan future therapy so that this is not omitted when the risk of bleeding has diminished. The insertion of an inferior vena cava filter should be considered.
2.48 There should be specific guidelines for acute pain relief in adults and children with major trauma.¹

2.49 Specific anaesthetic guidelines that should be in place include:
- the management of failed difficult intubation
- the management of regional techniques in relation to thromboprophylaxis
- the management of high regional block, accidental dural puncture and post-dural puncture headache.

2.50 There should be agreed anaesthetic protocols for orthopaedic day case anaesthesia

2.51 All hospitals proving joint-replacement surgery should have clear guidelines for enhanced recovery in place, in order to promote the benefits of early mobilization and reduced mortality associated with their use.

3 Areas of special requirement

Spinal injuries
3.1 The precautions used in suspected spinal injury should be clearly defined. These include the use of collars and blocks, placing the patient on a firm surface, log-rolling, and [for intubation] manual in-line immobilisation. A spinal clearance policy should address if and when the precautions can be relaxed in patients with distracting pain or altered consciousness.²

3.2 In suspected spinal injury, hard spinal boards should only be used as a pre-hospital extrication device and not be used for transport.³ A scoop stretcher or full-length vacuum mattress should be used for transfer. Spinal clearance should be achieved in a timely fashion, to minimise discomfort from collars, head blocks and prolonged immobilisation in patients who do not have spinal injuries.

3.3 Acute nerve or spinal cord compression requires immediate referral to a neurosurgeon or specialist spinal surgeon. Patients with a spinal cord injury should be referred to a consultant in the regional spinal cord injury rehabilitation centre, within four hours of identifying the injury.³³

3.4 Anaesthesia for patients undergoing MRI scanning after suspected spinal injury should be provided by consultant anaesthetists who have undergone specific training.³⁴

Jehovah’s Witnesses
3.5 In elective orthopaedic surgery where heavy blood loss is anticipated, specific measures should be considered in patients who are Jehovah’s Witnesses,³⁵ including re-infusion of post-operatively drained blood or cell salvage or alternative. 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.

Children
3.6 Children presenting for orthopaedic or trauma surgery must have access to appropriate facilities, staff and equipment.⁶,⁷ Services should be child friendly. Children and young people must be informed about, and have active involvement in, decisions related to their own ongoing care.

Rehabilitation
3.7 The rehabilitation team plays a vital role in major trauma care.² A referral should be made on day one. A formal rehabilitation prescription is an important element in the co-ordination of ongoing care.

3.8 Hip fracture patients should be assessed by a physiotherapist and, unless medically or surgically contraindicated, mobilised the day after surgery. Mobilisation should be offered at least once a day and regularly reviewed by a physiotherapist.

3.9 Early supported discharge should be considered as part of the hip fracture programme.⁸,⁹,¹⁰ provided the multidisciplinary team remains involved and the patient is medically stable, has the mental ability to participate in continued rehabilitation, is able to transfer and mobilise short distances, and has not yet achieved their full rehabilitation potential, as discussed with the patient, carer and family.
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. Additional training on the European Trauma Course (ETC) provides an understanding of human factors and promotes teamwork. Those who continue to practise major trauma care should continue to update ATLS or ETC 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. 36

4.3 Anaesthetists providing anaesthesia for trauma and orthopaedic surgery should learn and maintain expertise in a wide range of local anaesthetic techniques, to allow a versatile approach to patients with serious co-morbidity.

4.4 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.

4.5 All anaesthetists involved in the management of major trauma must understand the principles and techniques of aggressive haemorrhage control and prevention of coagulopathy.

4.6 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. Scenario practice sessions are of greatest value in a multidisciplinary setting. High-fidelity simulators should be available for specific training sessions. Well-organised, lower fidelity scenario training remains a valuable, complementary, cost-effective means of improving logistics and incorporating human factors training.

4.7 Consultants in trauma resuscitation anaesthesia and other consultant anaesthetists providing emergency anaesthesia for major trauma patients within an MTC should undergo periodic damage-control resuscitation training, jointly with their surgical consultant colleagues.

4.8 Major-incident training exercises should take place at regular intervals.

4.9 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. 67

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

4.11 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 or alternative.

4.12 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, audit and quality improvement

5.1 Research in anaesthesia for trauma and orthopaedic surgery should be encouraged. Staff undertaking research should have received training on ethical and organisational issues. They should complete a good clinical practice course with regular updates.

5.2 Each major trauma network should have an appointed research lead as part of the trauma programme board.

5.3 Trauma and orthopaedic surgery should be included in anaesthetic departmental audit programmes, including ongoing audit of complications and adverse events. The corresponding surgeons should be invited to meetings of mutual interest and concern.

5.4 All hospitals treating patients with hip fractures should submit complete data to the National Hip Fracture Database, to monitor its performance against national benchmarks and quality standards.
5.5 All hospitals receiving major trauma cases should contribute to the Trauma Audit and Research Network (TARN), to monitor its performance against national benchmarks and quality standards and contribute to research. Comparative data analysis and display on the national major trauma dashboard (via TARN) is invaluable for quality assurance.

5.6 MTCs and TUs in England must undergo regular peer reviews within the National Peer Review Programme. Their performance will be judged according to national major trauma measures. The measures cover reception and resuscitation, definitive care, and rehabilitation in adult MTCs, paediatric MTCs and TUs. Other measures cover pre-hospital care and overall network governance.

5.7 Critical care units should form part of a constituted critical care network and subscribe to a nationally recognised audit process).

5.8 All new spinal cord injury patients must be referred through the NHS Spinal Cord Injury Service (NSCIS) and registered on the national spinal cord injury database (NSCID). The incidence of complications should be recorded.

5.9 Major trauma governance meetings should follow the guidance from the World Health Organization (WHO). Multidisciplinary mortality and morbidity meetings should take place every one to four weeks in MTCs. Governance meetings should take place across the entire trauma network at defined intervals. Besides individual case discussion, feedback information from TARN should be disseminated, and mechanisms set in place to correct any problems identified.

5.10 In addition to mortality and morbidity meetings, WHO has made specific recommendations for preventable-death panels. They should take place across the entire network every one to three months.

5.11 Nationally agreed key performance indicators should be used to monitor the performance of the pathways for hip fractures and major trauma. In addition, local quality indicators should be developed proactively, to support continuing improvement of these services within organisations.

6 Organisation and administration

Hip fractures

6.1 Patients with a hip fracture should normally have surgical correction within 24 hours of admission to hospital. They should receive prompt, appropriate pain relief and adequate pre-operative hydration. Hip fracture surgery should be scheduled on a planned (and, ideally, dedicated) trauma list, during normal working hours.

6.2 A system should be in place to offer a formal hip fracture programme, based on an acute orthogeriatric or orthopaedic ward. This includes ‘fast tracking’ patients from the emergency department to the ward within four hours of presentation, rapid optimisation of fitness for surgery using standardised pre-operative investigations, timely surgery and early rehabilitation.

6.3 The involvement of orthogeriatricians in all phases of care in patients with hip fractures is vital.

Emergency orthopaedics and trauma

6.4 A triage tool, similar to that developed by the American College of Surgeons, should be used by pre-hospital personnel to identify patients with suspected major trauma.

6.5 Triage-positive patients should be sent directly to an MTC if the travelling time is under 60 minutes (or 45 minutes if agreed by the trauma network), unless there is an imperative to go to a closer TU for the immediate management of a life-threatening condition. The majority of patients presenting to TUs with major trauma should be transferred to an MTC after immediate management.

6.6 Triage-positive patients should not be taken to a local emergency hospital (LEH), in other words an acute hospital not accredited as a TU or MTC.
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6.7 In hospitals receiving patients with major trauma, there should be a multidisciplinary trauma team that includes an anaesthetist of ST4 or above, is led by a defined trauma team leader and is available 24 hours a day. The team should be called out in cases of suspected major trauma, on the basis of pre-hospital information, according to pre-defined criteria. The trauma team should also be called out if there are unexpected findings after arrival in triage-negative patients, and to receive patients following inter-hospital transfer.

6.8 Trauma team members should be called in advance of the patient’s arrival to allow time for briefing and drug and equipment preparation, whenever possible. A prompt response by team members is essential. The team should also assemble before receiving patients from other hospitals, allowing transferred imaging and treatment plans to be defined in advance.

6.9 There should be a defined agreement for immediate or emergency access to an operating theatre or intervention suite, with appropriately trained and experienced staff to provide rapid intervention in life-threatening or limb-threatening conditions. All patients requiring acute intervention for haemorrhage control must be in a definitive management area (operating room or intervention suite) within 60 minutes.

6.10 The trauma list may need to be interrupted between cases, or a separate theatre opened and staffed. A flexible approach to emergency theatre list planning and management is required.

6.11 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.

6.12 Vascular impairment requires emergency surgery and restoration of the circulation using shunts, ideally within three to four hours, with a maximum acceptable delay of six hours of warm ischaemia. The anaesthetic team should be engaged promptly, to achieve timely intervention.

6.13 Definitive skeletal stabilisation of open fractures and wound cover should be achieved within 72 hours.

6.14 There should be due consideration to the timing of major reconstructive surgery. The risk of the ‘second hit’ of the surgical intervention leading to organ failure is greater during days two to four after severe trauma. It is often wise to avoid major interventions at this time.

6.15 When appropriate, definitive surgery within the first day avoids unnecessary delays and reduces the length of stay. In order to achieve this, specific surgeons and anaesthetists may need to rearrange operating lists at short notice. This may involve postponing planned cases.

6.16 Displaced pelvic and acetabular fractures requiring reduction and internal fixation should generally undergo definitive surgery within five days and no later than ten days from injury.

6.17 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.

6.18 Consultant anaesthetists and intensivists should be involved in the planning of local trauma services. Those with defined responsibility for major trauma management should be engaged in the layout and logistics of the resuscitation room.

6.19 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.

6.20 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. The plan should be built around the network of MTCs, TUs and LEHs, with initial transfer of patients from the scene to these hospitals depending on the location of the incident and the major-incident triage categories (P1–4) ascribed at the scene.

6.21 The formal involvement of adjacent networks will be required in major incident management if the number of casualties is likely to overwhelm the network’s hospitals with the major incident plan in effect. This should also be considered in incidents that are close to network boundaries.
Elective orthopaedics

6.22 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.

6.23 Elective patients with major co-morbidities or those undergoing complex or prolonged surgery should not be scheduled late in the day, so that early post-operative stabilisation can be optimally supervised.

6.24 Hospitals should look to provide specific local anaesthesia lists, using a dedicated area for initiating and assessing local nerve blocks. Cohorting cases in this way fosters the development and maintenance of expertise in the anaesthetists and supporting staff and minimises delays between cases.

6.25 There should be a pre-operative assessment clinic for elective orthopaedic surgery. Given the high incidence of co-morbidity in these patients, there should be clear pathways for assessment and optimisation of medical conditions. There should be specific guidelines for assessing a suspected difficult airway in patients with spine and joint disease, and for measuring lung function in patients with kyphoscoliosis.

6.26 There should be an enhanced recovery programme for patients undergoing elective orthopaedic surgery, to improve the integration, efficiency and quality of care in suitable patients.39

7 Patient information

Information for patients, relatives and carers

7.1 For hip fractures, the National Institute for Health and Care Excellence (NICE) document that describes quality standards for hip fractures in layman’s terms should be made available for patients, relatives and carers.10

7.2 For major trauma, there should be a network-wide information booklet describing the major trauma services and providing relatives and carers with practical information on visiting the MTC from the surrounding areas. The important roles played by anaesthetists throughout the pathway should be clearly described.

7.3 For patients with spinal cord injuries and their families, there should be rapid access to advice from a consultant and other key professionals in the regional spinal cord injury rehabilitation unit.33 They should be made aware of the Spinal Injuries Association that provides information and support for patients with spinal cord injury and their families.

Patients with difficult airways

7.4 When an awake fibreoptic intubation is required, it is important to fully inform the patient of what to expect.

7.5 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

7.6 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.

7.7 Where alternative techniques with a similar level of risk are available, the patient’s preference should be taken fully into account.

Informed consent and the confused patient

7.8 Informed consent may be impossible for many patients undergoing hip fracture and major trauma surgery, owing 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 to do so. Standard operating procedures should be compliant with the Mental Capacity Act. A high level of integrity must be maintained, and good documentation is essential.
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Death and dying

7.9 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.

7.10 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.

7.11 When it is considered appropriate for an order not to attempt resuscitation in the event of a cardiopulmonary arrest (DNACPR), it must be discussed with competent patients, including those who have expressed their own wish not to be resuscitated. In patients not competent 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.

Further reading


References

- Hip fracture in the older person (BOAST 1, 2007); Spinal clearance (BOAST 2, 2008); Pelvic ring fractures and dislocations, acetabular fractures (BOAST 3, 2008); Severe lower limb fractures (BOAST 4, 2009). BOA, London [http://bit.ly/1tA4mYD].