Royal College of Anaesthetists

Chapter 14

Guidelines for the Provision of Anaesthesia Services (GPAS)

Guidelines for the provision of Neuroanaesthetic Services

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Chapter 14
Guidelines for the Provision of Neuroanaesthetic Services 2025

Authors

Dr Iby Adedugbe
Consultant Anaesthetist
National Hospital for Neurology and Neurosurgery

Dr Kyle Gibson
Locum Consultant in Anaesthetics & Critical Care
NHS Lothian

Dr Sandeep Lakhani
Consultant Anaesthetist
Clinical Director
The Walton Centre NHS Foundation Trust

Dr Lara Prisco
Consultant Anaesthetist
Research Lead in Neuroanaesthesia and Neurointensive Care
John Radcliffe Hospital, Oxford

Dr Sally Wilson
Consultant Anaesthetist
University College London Hospitals NHS Foundation Trust

Chapter Development Group members

Mr Andrew Brodbelt
Consultant Neurosurgeon, Lead for Neurosurgical Oncology
The Walton Centre NHS Foundation Trust

Dr Sumit Das
Consultant Paediatric Anaesthetist, Oxford Children's Hospital
Association of Paediatric Anaesthetists of Great Britain and Ireland

Mr Mike Donnellon
Chair of the Education and Standards Committee
The College of Operating Department Practitioners

Mr Robert Dudgeon
PatientsVoices@RCoA
Royal College of Anaesthetists

Dr Vijay Kumar
SAS Lead, RCoA Council
Royal College of Anaesthetists

Dr Sarah Nelson
Anaesthetist in Training
Torbay and South Devon NHS Foundation Trust

Dr Akshay Sule
Consultant Anaesthetist
The Walton Centre NHS Foundation Trust

Dr Oliver Tierney
The Association of Perioperative Practice (AfPP)

Dr James Wright
Anaesthetist in Training
University Hospitals Sussex NHS Foundation Trust

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Acknowledgements

Peer reviewers

Dr Paul Dias
Consultant Neuroanaesthetist
University Hospitals Birmingham NHS Foundation Trust

Dr Katharine Hunt
Consultant Anaesthetist
National Hospital for Neurology and Neurosurgery
University College Hospital NHS Foundation Trust

Dr John Westwood
Consultant Neuroanaesthetist
University Hospitals Birmingham NHS Foundation Trust

Chapter development technical team

Dr Rachel Evley
Senior Research Fellow
University of Nottingham

Ms Stephanie James
Royal College of Anaesthetists

Dr Jeremy Langton
GPAS Editor

Ms Ruth Nichols
Royal College of Anaesthetists

Ms Zviko Nuamah
Royal College of Anaesthetists

Declarations of interest

All chapter development group (CDG) members, stakeholders and external peer reviewers were asked to declare any pecuniary or non-pecuniary conflict of interest, in line with the guidelines for the provision of anaesthetic services (GPAS) conflict of interest policy as described in the GPAS chapter development process document.

The nature of the involvement in all declarations made was not determined as being a risk to the transparency or impartiality of the chapter development. Where a member was conflicted in relation to a particular piece of evidence, they were asked to declare this and then, if necessary, remove themselves from the discussion of that particular piece of evidence and any recommendation pertaining to it.

Medicolegal implications of GPAS guidelines

GPAS guidelines are not intended to be construed or to serve as a standard of clinical care. Standards of care are determined based on all clinical data available for an individual case and are subject to change as scientific knowledge and technology advance and patterns of care evolve. Adherence to guideline recommendations will not ensure successful outcome in every case, nor should they be construed as including all proper methods of care or excluding other acceptable methods of care aimed at the same results. The ultimate judgement must be made by the appropriate healthcare professional(s) responsible for clinical decisions regarding a particular clinical procedure or treatment plan. This judgement should only be arrived at following discussion of the options with the patient, covering the diagnostic and treatment choices available. It is advised, however, that significant departures from the national guideline or any local guidelines derived from it should be fully documented in the patient's case notes at the time the relevant decision is taken.

Promoting equality and addressing health inequalities

The Royal College of Anaesthetists (RCoA) is committed to promoting equality and addressing health inequalities. Throughout the development of these guidelines we have:

- given due regard to the need to eliminate discrimination, harassment and victimisation, to advance equality of opportunity, and to foster good relations between people who share a relevant Protected Characteristic (as defined in the Equality Act 2010) and those who do not share it
- given regard to the need to reduce inequalities between patients in access to, and outcomes from healthcare services and to ensure services are provided in an integrated way where this might reduce health inequalities.

GPAS Guidelines in context

The GPAS documents should be viewed as 'living documents'. The GPAS guidelines development, implementation and review should be seen not as a linear process, but as a cycle of interdependent activities. These in turn are part of a range of activities to translate evidence into practice, set standards and promote clinical excellence in patient care.

Each of the GPAS chapters should be seen as independent but interlinked documents. Guidelines on the general provision of anaesthetic services are detailed in the following chapters:

- Chapter 1: Guidelines for the Provision of Anaesthesia Services: The Good department
- Chapter 2: Guidelines for the Provision of Anaesthesia Services for the Perioperative Care of Elective and Urgent Care Patients.

These guidelines apply to all patients who require anaesthesia or sedation, and are under the care of an anaesthetist. For urgent or immediate emergency interventions, this guidance may need to be modified as described in Chapter 5: Guidelines for the Provision of Emergency Anaesthesia.

The rest of the chapters of GPAS apply only to the population groups and settings outlined in the 'Scope' section of these chapters. They outline guidance that is additional, different or particularly important to those population groups and settings included in the 'Scope'. Unless otherwise stated within the chapter, the recommendations outlined in chapters 1–5 still apply.

Each chapter will undergo yearly review, and will be continuously updated in the light of new evidence.

Guidelines alone will not result in better treatment and care for patients. Local and national implementation is crucial for changes in practice necessary for improvements in treatment and patient care.

Aims and objectives

The objective of this chapter is to promote current best practice for service provision in neuroanaesthesia. The guidance is intended for use by anaesthetists with responsibilities for service delivery and healthcare managers.

This guideline does not comprehensively describe clinical best practice in neuroanaesthesia but is primarily concerned with the requirements for the provision of a safe, effective, well-led service, which may be delivered by many different acceptable models. The guidance on provision of neuroanaesthesia applies to all settings where this is undertaken, regardless of funding. All age groups are included within the guidance unless otherwise stated, reflecting the broad nature of this service.

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A wide range of evidence has been rigorously reviewed during the production of this chapter, including recommendations from peer-reviewed publications and national guidance, where available. However, both the authors and the CDG agreed that there is a paucity of level 1 evidence relating to service provision in neuroanaesthesia. In some cases, it has been necessary to include recommendations of good practice based on the clinical experience of the CDG. We hope that this document will act as a stimulus to future research.

The recommendations in this chapter will support the RCoA's Anaesthesia Clinical Services Accreditation (ACSA) process.

Scope

Target audience
All staff groups working in neuroanaesthesia, including (but not restricted to) anaesthetists, operating department practitioners, anaesthesia associates, nurses, allied health professionals and pharmacy staff.

Target population
All ages of patients undergoing neuroanaesthesia.

Healthcare setting
All settings within the hospital in which neuroanaesthesia are provided.

Neurocritical care
- *Guidelines for the Provision of Intensive Care Services* covers neurocritical care within critical care settings (i.e. intensive care and high dependency units).[1]
- *Guidelines for the Provision of Anaesthesia Services* (GPAS) covers critical care patients in theatre, the overflow of critical care patients into post anaesthesia care units, the transfer of critical care patients to and from theatre (or other centres), critical care patients in interventional radiology, magnetic resonance imaging (MRI) hybrid suites and so on, as long as they are under the care of the department of anaesthesia.

Clinical management
- Key components needed to ensure provision of high-quality anaesthetic services for neuroanaesthesia.
- Areas of provision considered:
  - levels of provision of service, including (but not restricted to) staffing, equipment, support services and facilities.
  - areas of special requirement including children, critically ill patients, MRI and pregnant neurosurgical patients.
  - training and education
  - research and audit
  - organisation and administration
  - patient information.

Exclusions

- Provision of neuroanaesthesia services by a specialty other than anaesthesia.
- Provision of neurocritical care in a critical care unit.
- Clinical issues that will not be covered:
  - clinical guidelines specifying how healthcare professionals should care for patients
  - national level issues.

This guideline relates only to critically ill patients undergoing procedures in the operating theatre and neuroradiology department.

General provision of critical care is outside the scope of this document. Further information, including definitions of levels of critical care can be found in the Faculty of Intensive Care Medicine and Intensive Care Society publication *Guidelines for the Provision of Intensive Care Services*.

Introduction

Neuroanaesthesia encompasses a wide range of emergency and elective work. Anaesthesia for intracranial oncology, vascular, hydrocephalus, trauma/neurotrauma, functional surgery, complex spinal surgery, as well as anaesthesia for diagnostic and interventional neuroradiological procedures, including MRI, all lie within the specialty.

Neuroanaesthesia is mainly delivered in neuroscience units, which may be based in specialist centres, teaching hospitals or district general hospitals. Neuroanaesthesia input is often required as part of multidisciplinary working with patients with complex head and neck cases.

Service demands on the departments of neuroanaesthesia and neuroanaesthetists have changed. Recent developments such as mechanical thrombectomy in the management of ischaemic stroke have the potential to significantly increase service delivery requirements in the future. Staffing departments of neuroanaesthesia and neurocritical care will be influenced by the development of intensive care medicine as a separate specialty.

The recommendations in this chapter aim to provide guidance for departments of anaesthesia to help them ensure adequate and safe service provision of neuroanaesthesia.

Recommendations

The grade of evidence and the overall strength of each recommendation are tabulated in Appendix 1.

1 Staffing requirements

1.1 In each hospital providing neuroanaesthesia, a neuroanaesthetist should be appointed as the clinical lead (see Glossary) to manage service delivery. Adequate time for this role should be included in the lead's job plan.

1.2 There should be a specified and therefore identifiable group of neuroanaesthetists who cover the neuroanaesthesia service and these clinicians should have sufficient programmed activities to deliver the elective and emergency service.[2,3]

1.3 There should be designated consultants in referring hospitals and neuroscience units with overall responsibility for the organisation, infrastructure and processes to enable safe transfer of patients with a brain injury.[4]

1.4 An appropriately trained and experienced anaesthetist should be present for all neurosurgical operating lists and interventional neuroradiology sessions, with sufficient

consultant-programmed activities to provide adequate supervision and support to anaesthetists in training and staff grade, associate specialist or specialty (SAS) anaesthetists.[3,5]

1.5 Adequate anaesthetic cover should be available to provide general anaesthesia and sedation for diagnostic neuroradiology (i.e. brain and spine imaging) sessions, including computed tomography (CT) and MRI.

1.6 Hospitals should have well-integrated arrangements that ensure anaesthetists covering long neurosurgical procedures or overrunning lists have regular breaks covered by an appropriate colleague for refreshment and comfort breaks.[6,7,8,9] If a case is expected to run over three sessions, consideration should be given to organising a second anaesthetist.

1.7 There should be local policy and agreement on how to staff late running lists and lists scheduled to run more than three sessions to prevent fatigue and patient safety issues.

1.8 An appropriately skilled and experienced resident anaesthetist should be available at all times to care for postoperative and emergency patients. The experience and skills necessary to provide this cover are not usually found in anaesthetists in training in stage 1.[3]

1.9 Out of hours, consultants should be immediately available (see Glossary) by telephone for advice and be able to attend the hospital within 30 minutes. Suitably skilled and experienced theatre staff should also be available.

1.10 If the consultant on call is not a neuroanaesthetist, there should be a clearly defined and understood process for the provision of specialist advice from neuroanaesthesia colleagues. Where possible, local arrangements should be considered to facilitate this telephone advice in non-neuroscience centres when required.

1.11 Departments that participate in national initiatives (e.g. services for thrombectomy) should review their staffing arrangements to ensure timely emergency cover.[10,,11] Thrombectomy should have a protocol-led service, ideally staffed by neuroanaesthetists.[12]

1.12 Anaesthetic assistants should be appropriately skilled and should have up-to-date experience in neuroanaesthesia.

1.13 All post-anaesthetic recovery staff looking after neuroscience patients should be able to recognise and describe complications following neuroanaesthesia and should possess skills to obtain multidisciplinary assistance and escalate treatment according to departmental protocols and guidance.

1.14 Where departments use post-anaesthetic recovery units for extended recovery, the post-anaesthetic recovery staff caring for those patients should have a registered nurse or operating department practitioner: patient ratio of 1:2, as in a level 2 critical care unit. However, the care of an individual patient should be delivered on a one to one basis until the patient is able to maintain their own airway, has respiratory and cardiovascular stability and is able to communicate (where applicable).[8] Departments should have procedures in place to demonstrate the adequacy of medical cover for such extended recovery units.

2 Equipment, services and facilities

General equipment, services and facilities for anaesthesia are described in *Guidelines for the Provision of Anaesthesia Services for the Perioperative Care of Elective and Urgent Care Patients* and *Guidelines for the Provision of Emergency Anaesthesia*. Specialised recommendations for neuroanaesthesia are given below.

Equipment

2.1 Specific equipment for difficult airway management should be available in a clearly labelled trolley.

2.2 Units should have access to ultra-short-acting opioids with stable context-sensitive half times deliverable by infusion using software accommodating a range of appropriate pharmacokinetic models that permits intraoperative cardiostability, smooth emergence from anaesthesia and rapid and accurate postoperative neurological assessment.

2.3 Equipment that complies with Association of Anaesthetists standards for anaesthetic monitoring should be available.[13]

2.4 Consideration should be given to continuing as much clinically indicated neuromonitoring as safely possible when the patient is transferred between critical care unit, theatres, interventional suite, MRI and CT scanners.[14,15]

2.5 Monitoring equipment to detect venous air embolism and catheters for air aspiration should be available. The use of multiorifice catheters should also be considered.[16,17]

2.6 Those units conducting functional neurosurgery or surgery for correction of scoliosis, other relevant spinal surgery, or surgery for some cranial lesions (e.g. cerebellopontine angle tumours) should have the appropriate equipment and adequate numbers of trained staff for intraoperative neurophysiological testing. Neuroanaesthetists should be aware of the implications of this testing for anaesthesia, including blood pressure management, use of neuromuscular blockade, and the use of total intravenous anaesthesia.[14,17,18,19]

2.7 Equipment for safe positioning of patients with a wide range of body habitus should include:

- appropriately sized mattresses
- positioning aids to minimise risk of eye injury, nerve injury as well as skin damage (e.g. pressure sores) during potentially prolonged operations
- fixings to prevent accidental movement during the procedure.

2.8 Equipment to monitor patient temperature and to provide targeted temperature management should be available.[20]

2.9 Availability of a cell salvage system should be considered for procedures associated with a risk of blood loss greater than 500 ml or exceeding 25% of circulating volume.[21,22,23] Staff who operate this equipment should receive training in how to operate it and should use it frequently to maintain their skills.

2.10 The department should consider having a mobile phone available to staff for transfers of brain-injured patients.[4] The transferring team should have access to mobile phones with the relevant contact details during the transfer to enable them to communicate with the receiving unit if required.

Support services

2.11 There should be same-day availability of ultrasound investigations, including echocardiography.

2.12 Neuroradiology support should be available 24/7 for interpretation of neuroimaging.

2.13 In hospitals with a dedicated neuroanaesthesia service dedicated neurology input should be available.

2.14 Online imaging results from referring hospitals and within the neuroscience centre should be available locally, and consideration should be given to the provision of remote access for all anaesthetists who provide cover to neuroanaesthesia out of hours.

2.15 There should be onsite laboratory provision or near-patient testing for blood gases, serum electrolytes, platelet function assay (if available), activated clotting time and viscoelastic haemostatic assays to allow safe management of patients in the operating theatre and angiography suite.[24]

2.16 Rapid access to other biochemical and haematological investigations and blood transfusion should be provided.[25]

Facilities

2.17 Transfer times between the procedure room and critical care should be minimised. In new buildings, this may be achieved by having theatres, the critical care unit and radiological facilities within close proximity and preferably on the same floor. An integrated approach should be taken when planning new facilities.[29]

2.18 Post-anaesthetic recovery facilities with appropriately trained staff and equipment should be available for elective and non-elective procedures.[26]

3 Areas of special requirement

Children

General recommendations for children's services are described in *GPAS Chapter 10: Guidelines for the Provision of Paediatric Services*.

3.1 Whether in a dedicated paediatric neurosurgical unit or not, every child requiring elective neurosurgery should have care delivered by an anaesthetist or anaesthetists who possess the relevant competencies as demanded by the patient's age, disease and comorbidities.

3.2 New appointees to consultant posts with a significant or whole-time interest in paediatric neuroanaesthesia should have successfully completed stage 3 training in paediatric anaesthesia as defined in the certificate of completion of training (CCT) in anaesthesia.[27]

3.3 Paediatric and neuroscience centres should consider partnering to help each to maintain expertise of the other area.

3.4 In a true emergency situation involving a child requiring urgent neurosurgery for a deteriorating condition admitted to an 'adult only' neurosurgical service, the most appropriate surgeon, anaesthetist and intensivist available would be expected to provide lifesaving care, including emergency resuscitation and surgery.[28]

3.5 Equipment and accessories appropriate for the age and size of any patient should be available and maintained in accordance with manufacturers' recommendations.

3.6 In non-paediatric centres, appropriate immediate neurocritical care facilities should be available for all children until they can be transferred to a specialist centre.

Critically ill patients

Many patients who undergo neurosurgery will be cared for pre or postoperatively in a critical care setting. Many neuroanaesthetists also work in neurocritical care settings. The provision of neurocritical care in a critical care setting is outside the scope of this chapter and is described in the *Guidelines for Provision of Intensive Care Services*.[1]

3.7 Neurocritical care should commence/continue in theatre; therefore standard operating protocols for invasive lines, monitoring and tracheal tubes should reflect local critical care policy.

3.8 Departments of emergency medicine may also wish to adopt these standard operating procedures.

Magnetic resonance imaging

Recommendations on the provision of anaesthesia services for imaging services are described comprehensively in *GPAS Chapter 7: Guidelines for the Provision of Anaesthesia Services in the Non-theatre Environment*. Increasing numbers of neurosurgical units will have an interventional magnetic resonance (MR) suite that combines an operating theatre with an adjacent MR scanner; either in the same room or separated by shielded doors.

3.9 All staff working in MRI units must be trained in MR safety. The use of checklists before transfer to the scanner should be routine.[29]

Mechanical thrombectomy services

3.10 Mechanical thrombectomy for acute ischaemic stroke should be available in specialist stroke centres; most are based within neurosurgical units. This will involve a formal network with an acute stroke centre served by regional comprehensive stroke centres.

3.11 Anaesthetic support for mechanical thrombectomy should involve anaesthetic staff with appropriate training and experience in neuro-anaesthetic care and remote site anaesthesia. Operating department practitioner/anaesthetic nurse support should be available.[30]

3.12 Protocols should be developed to ensure that accurate clinical information is available in a timely manner to the anaesthetist to avoid any delays in treatment. There should be an agreed process for alerting the mechanical thrombectomy team if anaesthetic provision is unavailable to allow referral to another mechanical thrombectomy centre.

3.13 The decision whether to perform mechanical thrombectomy under local or general anaesthesia is based on the individual patient; with close communication with the neurointerventionalist. All patients should receive monitoring with the provision to convert to a general anaesthetic if needed.[13]

3.14 Agreed local guidelines should include who should be managed under general anaesthesia.

3.15 Anaesthetic care should be consultant or autonomously practising anaesthetist led, when possible. A neurocritical care facility should be available if needed after the procedure or a monitored bed on a hyperacute stroke unit as appropriate.

3.16 All units should audit their practice regularly to look at types of anaesthesia, timing, agents used and complications and review of service delivery.

Pregnant neurosurgical patients

Recommendations on the provision of anaesthesia services for the obstetric population are comprehensively described in *GPAS Chapter 5: Guidelines for the Provision of Emergency Anaesthesia Services 2022*.

4 Training and education

Opportunities for neuroanaesthesia training occur particularly during stage 2 and stage 3 (specialist interest area). Some anaesthetists in training (especially those considering a career in

neuroanaesthesia or critical care) may opt for a further or longer attachment as a specialist interest area in stage 3 of the curriculum.

4.1 Any autonomously practising anaesthetist working in neuroanaesthesia must undertake continuing professional development (CPD) in neuroanaesthesia and must have sufficient regular programmed activities within this field to ensure that their specific skills and experience are maintained.[27]

4.2 Departments should consider providing newly appointed consultants with a mentor to facilitate their development especially in a sub-speciality they may have limited experience.

4.3 Consultant anaesthetists who provide out of hours cover to the neuroscience unit but do not provide neuroanaesthesia in working hours should be able to demonstrate the maintenance of appropriate skills and knowledge through regular clinical involvement and CPD.

4.4 Elective neuroanaesthesia for highly specialised procedures that have limited case numbers (e.g. craniofacial procedures, awake neurosurgery and deep brain stimulation) should be provided by a dedicated subgroup of neuroanaesthetists within the department to ensure that they are able to treat sufficient numbers to maintain their competence in these areas.

4.5 The use of simulation training for critical incident scenarios should be available to all members of the multidisciplinary team. Examples include the cardiopulmonary resuscitation of patients not in the supine position, patients with their head pinned, or where anaesthesia is being provided in an isolated site.[31]

4.6 As anaesthetists in training spend limited time in the specialty, departments should facilitate the delivery of structured training programmes, developed by the school of anaesthesia.[5]

4.7 Anaesthetists in training should be encouraged to attend other training opportunities within the neuroscience unit, such as grand rounds, radiology and pathology case conferences, and morbidity and mortality meetings.

4.8 Fellowship posts should be identified to allow additional training for those who wish to follow a career in neuroanaesthesia or neurocritical care.[32] Such posts should provide similar or enhanced levels of teaching, training and access to study leave as regular training posts.

5 Organisation and administration

Detailed recommendations for organisation and administration of anaesthesia services can be found in *GPAS* *Chapter 2: Guidelines for the Provision of Anaesthesia Services for Perioperative Care of Elective and Urgent Care Patients*.

5.1 Much of neurosurgery involves acute work with a high degree of urgency. The provision of associated services should recognise this need and inappropriate delay should not be allowed to occur as a result of lack of key personnel or facilities. Laboratory services, neuroradiology, availability of operating theatre time and sufficient levels 1–3 bed provision should all be organised to cope with these demands.

5.2 There should be sufficient numbers of clinical programmed activities in consultants' job plans to provide cover for all elective neurosurgical operating lists and to provide adequate emergency cover.

5.3 Departments of neuroanaesthesia and neurocritical care, even if part of a large general department, should be provided with adequate secretarial and administrative support.

5.4 The neuroanaesthesia multidisciplinary team should be involved in the local and regional planning of relevant neuroscience services (e.g. thrombectomy).

5.5 Face-to-face and/or telemedicine preadmission clinics for elective neurosurgery should be available, with early input from the department of neuroanaesthesia, particularly for high-risk patients and those where additional time and discussion are required, such as awake craniotomy.[33] All centres should be able to demonstrate that discussion of perioperative risk is routine and that specific risks related to, for example prone positioning, are communicated.[34,35,36]

5.6 Preoperative assessment clinics should ensure that the patient is optimised as best as possible for elective neurosurgery (e.g. for correction of anaemia), as this can reduce the length of hospital stay, need for blood transfusion and postoperative morbidity.[25]

5.7 Patients suitable for daycase neurosurgery should be identified and should follow an agreed pathway.[37]

5.8 Hospitals should have systems in place to facilitate multidisciplinary meetings for neuroscience services.

5.9 A World Health Organization (WHO) checklist adapted for neuroscience procedures should be in use.[38]

5.10 The theatre team should all engage in the use of the WHO surgical safety process, commencing with a team brief and concluding the list with a team debrief.[38] Debrief should highlight things done well and should also identify areas requiring improvement. Teams should consider including the declaration of emergency call procedures specific to the location as part of the team brief.

5.11 For standalone neuroscience centres, local arrangements should be in place for specialist opinion and review of patients by other disciplines. A named consultant neuroanaesthetist should be identified to facilitate such liaison.

5.12 Hospitals should review their local standards to ensure that they are harmonised with the relevant national safety standards (e.g. National Safety Standards for Invasive Procedures in England or the Scottish Patient Safety Programme in Scotland).[39,40]

5.13 Local guidance should be developed for the intrahospital transfer of neuroscience patients, based on guidance from the Neuroanaesthesia and Neurocritical Care Society (NACCS), the Association of Anaesthetists and the Intensive Care Society.[41,42,43]

5.14 Each department should appoint a designated liaison consultant responsible for identifying the strategic pathways and logistical pitfalls of the intrahospital transfer of neurosurgical patients. The appointment should ensure that any identified problems are either removed or mitigated.

5.15 Communication with critical care should occur at the earliest possible time (preoperative clinic letter) to enhance the appropriate allocation of beds.

Postoperative procedures

5.16 Standardisation of the handover process can improve patient care by ensuring information completeness, accuracy and efficiency.[44,45] The use of perioperative care bundles should be considered.[42]

5.17 The 24/7 acute pain service should be available for neurosurgical patients and staff should be trained to address the specific needs of neurosurgical patients, such as those with impaired communication.[46]

5.18 Pain is a useful outcome measure for audit.[47,48] The utility of specific local and regional techniques for neurosurgical patients is established and pain teams should be aware of these techniques.[46,49]

5.19 Postoperative cognitive deficit (POCD) and delirium can be masked by a patient's neurological condition. Identifying the potential causes for POCD and surveillance for delirium should be a part of the entire perioperative patient journey for all staff and the condition should be managed appropriately by the multidisciplinary team.[8,49,50,51]

6 Financial considerations

Part of the methodology used in this chapter in making recommendations is a consideration of the financial impact for each of the recommendations. Very few of the literature sources from which these recommendations have been drawn have included financial analysis.

The vast majority of the recommendations are not new recommendations, but they are a synthesis of already existing recommendations. The current compliance rates with many of the recommendations are unknown, and so it is not possible to calculate the financial impact of the recommendations in this chapter being widely accepted into future practice. It is impossible to make an overall assessment of the financial impact of these recommendations with the currently available information.

6.1 It is recognised that equipment for neurosurgical patients can be expensive; this should be considered through business models.

7 Research, audit and quality improvement

7.1 Departments of neuroanaesthesia should be encouraged to develop research interests, even if not part of an academic department. Research collaboration with other neuroscience disciplines is good practice. Taking part in national anaesthesia and critical care projects is to be encouraged.[41,52]

7.2 Audit programmes should be developed locally but should include continuous audit of transfer of neuroscience patients, neurocritical care capacity and demand, rates of unplanned admission and readmission to the intensive care unit, and the caseload of anaesthetists in training, among others. In general, local practice should be audited against compliance rates with national and expert consensus guidelines.[5,41,53]

7.3 Collaborative audit with the other neuroscience disciplines should be encouraged, as well as close liaison and joint transfer audits with referring hospitals.[6]

7.4 Regular morbidity and mortality meetings should be held jointly with neurosurgeons, interventional neuroradiologists and other relevant stakeholders.

7.5 All departments should maintain active links to national bodies and societies (e.g. NACCS Link Doctor Scheme) to facilitate national audit and dissemination of information.

7.6 Clinical research staff allocation to clinical activities (beyond those job planned) should be limited to situations of major strain in the resources, such as major departmental emergencies.[54]

8 Implementation support

The Anaesthesia Clinical Services Accreditation (ACSA) scheme, run by the RCoA, provides a set of standards based on the recommendations contained in the GPAS chapters. As part of the scheme, departments of anaesthesia self-assess against the standards and undertake quality improvement projects to close the gap. Support is provided by the RCoA in the form of the good practice library,

which shares documents and ideas from other departments on how to meet the standards. Further advice can be obtained from the ACSA team and department's assigned College guide.

The ACSA standards are regularly reviewed on at least a three yearly basis to ensure that they reflect current GPAS recommendations and good practice. This feedback process works both ways and the ACSA scheme regularly provides CDGs with comments on the GPAS recommendations, based on departments' experience of implementing the recommendations.

Further information about the ACSA scheme can be found here: https://www.rcoa.ac.uk/safety-standards-quality/anaesthesia-clinical-services-accreditation

9 Patient information

The Royal College of Anaesthetists has developed a range of Trusted Information Creator Kitemark-accredited patient information resources that can be accessed from the RCoA website, including information on sedation, resources for children and young people and accessible resources. Our main leaflets are now translated into more than 20 languages, including Welsh.

Detailed recommendations regarding patient information and consent are described in *Guidelines for the Provision of Anaesthesia Services for the Perioperative Care of Elective and Urgent Care Patients*.

9.1 Patients should be provided written information (in a format of their choice) specific to the neurosurgical procedure they are planned to undergo, which explains the procedure, any preoperative preparation required, the risks, benefits and relevant advice in an easy to understand language.

9.2 All patients (and relatives where appropriate and relevant) should be fully informed about the planned procedure and should be encouraged to be active participants in decisions about their care, including the option of doing nothing.[8]

9.3 For patients undergoing diagnostic procedures such as MRI, although separate written consent for anaesthesia is not mandatory in the UK, all discussions about sedation and anaesthesia should be documented. Discussion should include methods of induction, associated risks, side effects and potential benefits of the procedure. It is not the responsibility of the anaesthetist to explain the indications for the procedure.[55,56]

9.4 If the patient is planned to be discharged on the same day after their procedure, relevant information should be provided on discharge, including contact details for the neurosurgical service. Other relevant recommendations for daycase anaesthesia outlined in Guidelines for the Provision of Anaesthesia Services for Day Surgery should be followed.[57]

9.5 For procedures such as awake craniotomies, departments should consider giving patients information in different formats including audiovisual. Consideration should be given to offering patients who are anxious about their awake procedure a prior visit to various areas of operating theatres.

9.6 The possibility of a parent or carer being present at induction and/or during recovery from anaesthesia should be explored where this is considered to be in the best interests of the patient.

Areas for future development

We recommend that further consideration be given to research in the following areas:

- development of daycase neurosurgery, including craniotomies

- enhanced recovery for neurosurgical patients
- the use of cardiopulmonary exercise testing and other prognostic tools for neurosurgical patients
- routine use of echocardiography following subarachnoid haemorrhage
- employment of anaesthesia associates for the provision of neuroanaesthesia services in conjunction with consultants
- effectiveness and accuracy of early warning scores in neurosurgical patients
- use of virtual preoperative assessment clinics for assessment of long-distance patients in tertiary neurosurgical centres
- use of retrieval teams to transfer emergency patients
- use of processed EEG monitors during inter- and intrahospital transfer for neurosurgical patients undergoing ventilation of the lungs with neuromuscular blockade.

Abbreviations

ACSA	Anaesthesia Clinical Services Accreditation
CDG	Chapter Development Group
CPD	continuing professional development
CT	computed tomography
EEG	electroencephalography
GMC	General Medical Council
GPAS	Guidelines for the Provision of Anaesthetic Services
MR	magnetic resonance
MRI	magnetic resonance imaging
NACCS	Neuro Anaesthesia and Neurocritical Care Society
RCoA	Royal College of Anaesthetists
WHO	World Health Organization

Glossary

Autonomously practising anaesthetist – a consultant, or an associate specialist, specialist doctor and speciality doctor (SAS) doctor who can function autonomously to a level of defined competencies, as agreed within local clinical governance frameworks.

Clinical lead – doctors undertaking lead roles should be autonomously practising doctors who have competence, experience and communication skills in the specialist area equivalent to consultant colleagues. They should usually have experience in teaching and education relevant to the role and they should participate in quality improvement and CPD activities. Individuals should be fully supported by their clinical director and should be provided with adequate time and resources to allow them to effectively undertake the lead role.

Immediately – unless otherwise defined, 'immediately' means within five minutes.

Neuroanaesthetist – will have regular neuroscience sessions (most often at least two sessions per week), will be involved in neuroscience morbidity and mortality conferences and will carry out regular CPD in this area.

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Appendix 1: Recommendations grading

The grading system is outlined in the methodology section of this chapter. The grades for each of the recommendations in this chapter are detailed in the table below:

Recommendation Number	Level of Evidence	Strength of Recommendation
1.1	GPP	Strong
1.2	C	Strong
1.3	C	Strong
1.4	C	Strong
1.5	GPP	Strong
1.6	C	Strong
1.7	GPP	Strong
1.8	C	Strong
1.9	GPP	Strong
1.10	GPP	Strong
1.11	C	Strong
1.12	GPP	Strong
1.13	GPP	Strong
1.14	GPP	Strong
2.1	GPP	Strong
2.2	GPP	Strong
2.3	C	Strong
2.4	B	Strong
2.5	C	Strong
2.6	B	Strong
2.7	GPP	Strong
2.8	B	Strong
2.9	C	Moderate

2.10	C	Moderate
2.11	GPP	Strong
2.12	GPP	Strong
2.13	GPP	Strong
2.14	GPP	Strong
2.15	C	Strong
2.16	B	Strong
2.17	B	Strong
2.18	C	Strong
3.1	GPP	Strong
3.2	C	Strong
3.3	GPP	Moderate
3.4	C	Moderate
3.5	GPP	Strong
3.6	GPP	Strong
3.7	GPP	Strong
3.8	GPP	Moderate
3.9	GPP	Strong
3.10	GPP	Strong
3.11	GPP	Strong
3.12	C	Strong
3.13	C	Strong
3.14	GPP	Strong
3.15	GPP	Strong
3.16	GPP	Strong
4.1	C	Strong
4.2	GPP	Strong

4.3	GPP	Strong
4.4	C	Strong
4.5	C	Strong
4.6	GPP	Strong
4.7	B	Strong
4.8	B	Strong
5.1	GPP	Strong
5.2	GPP	Strong
5.3	GPP	Strong
5.4	GPP	Strong
5.5	B	Strong
5.6	B	Strong
5.7	B	Strong
5.8	GPP	Strong
5.9	C	Strong
5.10	C	Strong
5.11	GPP	Strong
5.12	C	Strong
5.13	C	Strong
5.14	GPP	Strong
5.15	GPP	Strong
5.16	B	Strong
5.17	C	Strong
5.18	B	Strong
5.19	C	Strong
6.1	GPP	Strong
7.1	C	Strong

7.2	C	Strong
7.3	C	Strong
7.4	GPP	Strong
7.5	GPP	Strong
7.6	C	Moderate
9.1	GPP	Strong
9.2	C	Strong
9.3	C	Moderate
9.4	C	Strong
9.5	GPP	Moderate
9.6	GPP	Moderate

About these guidelines

Methodology

The process by which this chapter has been developed has been documented within the GPAS Chapter Development Process Document, which is available on request.

The evidence included in this chapter is based on a systematic search of the literature. Abstracts were independently screened by two investigators and reviewed against inclusion and exclusion criteria. Data were extracted by one investigator in accordance with predefined criteria. The review objective was to determine the key components needed to ensure provision of high-quality perioperative services for patients who have undergone surgery and/or interventions which involve anaesthesia.

Search strategy

Searches were performed on Embase (1980 to 2015), Ovid MEDLINE (1946 to present), CINAHL and Cochrane Library, for the literature search strategy, outcomes, databases, criteria for inclusion and exclusion of evidence (for the full Neuroanaesthetic services chapter search protocol please contact the RCoA). A hand search of the literature was also conducted by the authors using the reference lists of relevant original articles and review articles.

The literature search was performed in June 2022.

The authors and researcher independently reviewed the abstracts and titles of the studies found in the initial search. After agreement on the primary selection of papers, full-text versions were accessed and reviewed against the following predefined inclusion and exclusion criteria. The full-text papers were also reviewed by the CDG for suitability. The final list of publications used can be found in the references.

Inclusion criteria

The literature review considered studies that included the following patient population with all of the inclusion criteria listed below:

- all patients undergoing elective or emergency anaesthesia
- all staff groups working within Neuroanaesthetic care, under the responsibility of an anaesthetic clinical director, including (but not restricted to) consultant anaesthetists, autonomously practising anaesthetists, anaesthetists in training, nurses, operating department practitioners, surgeons, pharmacists, general practitioners, radiologists and radiographers.

Exclusion criteria

The literature review used the following exclusion criteria:

- provision of neuroanaesthesia provided by a speciality other than anaesthesia.

Data extraction and analysis

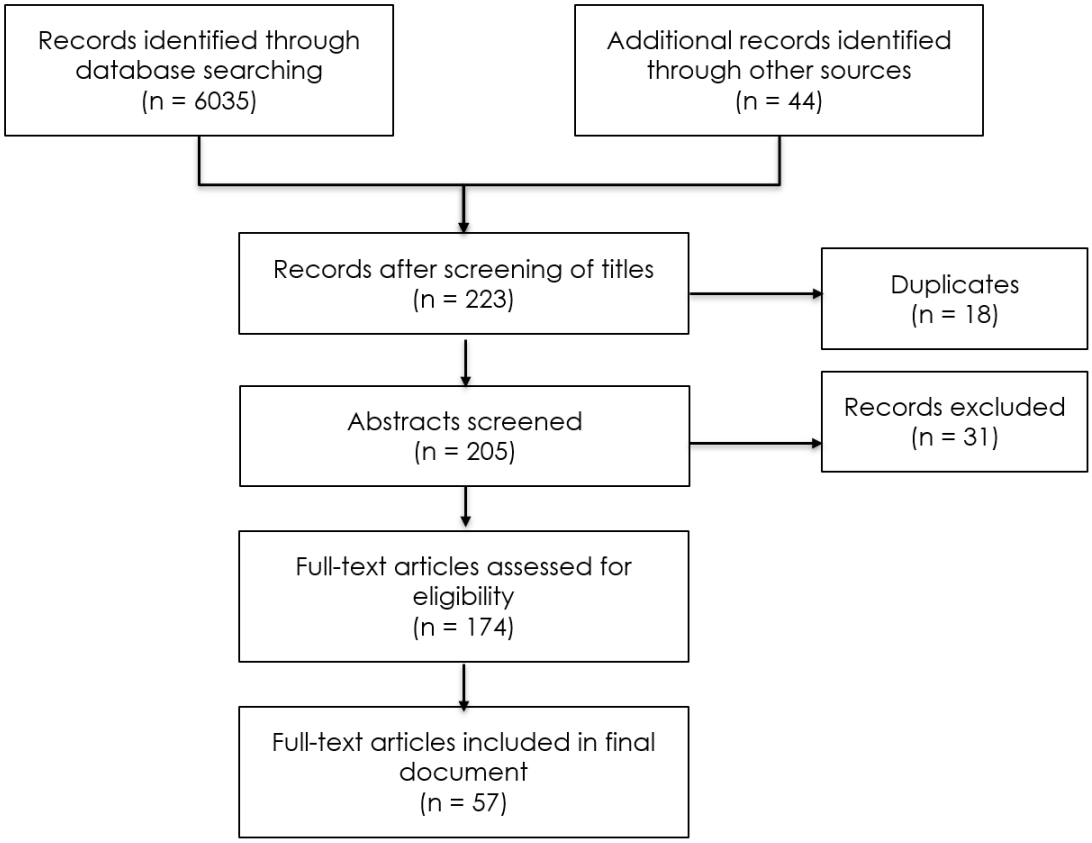
Data were extracted by the authors using a proforma. The study characteristics data included:

- the journal and country of publication
- the number of patients recruited into the study
- the study design
- patient characteristics
- outcome data
- the logic of the argument
- author's conclusions
- reviewer's comments.

The patient characteristics data extracted were: age, gender and type of surgery. The analysis considers studies that included any clinical outcome, including (but not restricted to) survival, length of stay – critical care or hospital, morbidity, adverse effects and complications.

The results of the literature review can be seen below:

Preferred Reporting Systems for Systematic Review and Meta-analysis (PRISMA) flow chart



The evidence that is included in this chapter has been graded according to a grading system adapted from NICE and outlined below:

Level	Type of evidence	Grade	Evidence
Ia	Evidence obtained from a single large/multicentre randomised controlled trial, a meta-analysis of randomised controlled trials or a systematic review with a low risk of bias	**A**	At least one randomised controlled trial as part of a body of literature of overall good quality and consistency addressing the specific recommendation (evidence level I) without extrapolation
Ib	Evidence obtained from meta-analyses, systematic reviews of RCTs or RCTs with a high risk of bias	**B**	Well-conducted clinical studies but no high-quality randomised clinical trials on the topic of recommendation (evidence levels Ib, II or III); or extrapolated from level Ia evidence
IIa	Evidence obtained from at least one well-designed controlled study without randomisation		
IIb	Evidence obtained from at least one well-designed quasi-experimental study		
IIc	Evidence obtained from case control or cohort studies with a high risk of confounding bias		
III	Evidence obtained from well-designed non-experimental descriptive studies, such as comparative studies, correlation studies and case studies		
IV	Evidence obtained from expert committee reports or opinions and/or clinical experiences of respected authorities	**C**	Expert committee reports or opinions and/or clinical experiences of respected authorities (evidence level IV) or extrapolated from level I or II evidence. This grading indicates that directly applicable clinical studies of good quality are absent or not readily available.
UG	Legislative or statutory requirements	**M**	This grading indicates that implementation of this recommendation is a statutory requirement, or is required by a regulatory body (e.g. CQC, GMC)
		GPP	Recommended good practice based on the clinical experience of the CDG.

Adapted from Eccles M, Mason J. How to develop cost-conscious guidelines. *Health Technology Assessment* 2001;5(16) and Mann T. Clinical guidelines: using clinical guidelines to improve patient care within the NHS. *Department of Health*, London 1996.

Strengths and limitations of body of evidence

Most of the published evidence on perioperative care anaesthesia services is descriptive. There are publications describing aspects of this process based on expert opinion.

The limitations of the evidence are:

- the 'unmeasurables' (attitudes, behaviour, motivation, leadership, teamwork)
- few randomised controlled trials (RCTs); studies frequently use mixed populations of emergency and elective patients, or all emergency patients grouped together despite different underlying diagnoses
- papers often examine a single intervention within complex system or bundle
- papers are often examining small numbers and/or patients from a single centre
- poor use of outcome measures, frequently concentrating on easily measured short-term outcomes which are not patient centred
- generally, a paucity of long-term follow up
- there is no standard definition used of 'high risk'
- use of different risk-scoring systems
- decrease in outcome over time and geography when 'good papers' are used in quality improvement programmes
- application of international studies in systems with either more or less resources than the UK into NHS practice
- older studies may no longer be applicable within the NHS
- very few studies included any analysis of financial implications
- evidence was mainly based on literature graded III and IV.

Methods used to arrive at recommendations

Recommendations were initially drafted based on the evidence by the authors for the chapter. These were discussed with the CDG, and comments were received both on the content and the practicality of the recommendations. The level of evidence that was the basis for each recommendation was graded according to a grading system, and the recommendation was then graded taking into account the strength of the evidence and the clinical importance using a recommendations criteria form.

Recommendations were worded using the following system of categorisation:

Strength	Type of evidence	Wording
Mandatory	The evidence supporting the recommendation includes at least one with an 'M' grading	Wording should reflect the mandatory nature of the recommendation i.e. 'must'
Strong	Confidence that for the vast majority of people, the action will do more good than harm (or more harm than good)	Wording should be clearly directive 'should' or 'should not'
Weak	The action will do more good than harm for most patients, but may include caveats on the quality or size of evidence base or patient preferences	Wording should include 'should be considered'
Aspirational	While there is some evidence that implementation of the recommendation could improve patient care, either the evidence or the improvement is not proven or substantial	Wording should include 'could'
Equipoise	There is no current evidence on this recommendation's effect on patient care	Wording should include 'there is no evidence of this recommendation's effect on patient care'

Consultation

The chapter has undergone several rounds of consultation. The multidisciplinary CDG formed the first part of the consultation process. The authors and GPAS Editorial board identified key stakeholder groups. Where stakeholders are represented by an association or other medical college, they were asked to nominate delegates to join the CDG. The GPAS Chapter Development Process Document (available on request) explains the recruitment process for those CDG members who were not directly nominated. The CDG members were involved in drafting the recommendations, and were provided with an opportunity to comment on all subsequent drafts of the chapter.

The chapter underwent peer review. Peer reviewers were identified by the GPAS Editorial Board, Clinical Quality and Research Board (CQRB) or through the Clinical Leaders in Anaesthesia Network. Nominees were either anaesthetists of consultant grade or were nominated by a key stakeholder group. Nominees had not had any involvement in the development of GPAS to date and were asked to comment upon a late draft of the chapter.

Following peer review, the chapter was reviewed by the College's CQRB and PatientsVoices@RCoA. Comments from all groups were considered and incorporated into a consultation draft.

The consultation draft of this chapter was circulated for public consultation from TBC. As well as being made available on the College's website and promoted via Twitter and the President's newsletter to members, the draft was also circulated to all key stakeholder groups identified by the

authors and the College. A list of organisations contacted by the College is available from the GPAS team at the College: GPAS@rcoa.ac.uk.

The editorial independence of GPAS

The development of GPAS is wholly funded by the Royal College of Anaesthetists. However, only the GPAS technical team and the GPAS researcher are paid directly by the College for their work on GPAS: the GPAS Editors' employing organisation receives 2 programmed activities (PA) backfill funding. All funding decisions by the College are made by the chief executive officer, in collaboration with the senior management team and College Council.

The authors of the chapters are all fellows of the Royal College of Anaesthetists. Members of College Council cannot act as chair of any CDG, as this individual has the deciding vote under the consensus method of decision making used in the chapters. Where College Council members have been involved in chapter development, this has been declared and recorded.

All persons involved in the development of GPAS are required to declare any pecuniary or non-pecuniary conflict of interest, in line with the GPAS conflict of interest policy as described in the GPAS Chapter Development Process Document (available on request). Any conflicts of interest are managed on a case-by-case basis to maintain the transparency and impartiality of the GPAS document. The conflicts, and the way they were managed, are outlined at the beginning of the chapter.

The role of the GPAS Editorial Board and CQRB

The overall development of the entire GPAS document is overseen by the CQRB of the Royal College of Anaesthetists, which includes representatives from all grades of anaesthetist and from clinical directors, and which also has PatientsVoices@RCoA representation.

Responsibility for managing the scope of the document and providing clinical oversight to the project technical team is delegated by the CQRB to the GPAS Editorial Board, which includes individuals responsible for the various internal stakeholders (see above for membership). On the inclusion/exclusion of specific recommendations within each chapter, the Editorial Board can only provide advice to the authors. In the event of disagreement between the authors, the majority rules consensus method is used, with the GPAS Editor holding the deciding vote.

Both of these groups, along with the PatientsVoices@RCoA, review each chapter and provide comment prior to public consultation and are responsible for signoff before final publication. In the event of disagreement, consensus is reached using the majority rules consensus method, with the chair of CQRB holding the deciding vote.

Updating these guidelines

This chapter will be updated for republication in January 2025.

Guidelines will be updated on an annual basis. The researcher will conduct the literature search again using the same search strategy to uncover any new evidence and members of the public will be able to submit new evidence to the GPAS project team. Where new evidence is uncovered, the lead author will decide whether the recommendations that were originally made are still valid in light of this new evidence.

If new evidence contradicts or strengthens existing recommendations, the authors decide whether or not to involve the remainder of the CDG in revising the recommendations accordingly.

If new evidence agrees with existing recommendations, then a reference may be added but no further action is required.

If there is no new evidence then no action is required.

This chapter is due to be fully reviewed for publication in January 2028.

Every five years guidance will be submitted to a full review involving reconvening the CDG (or appointment of a new, appropriately qualified CDG), and the process described in the methodology section of this chapter begins again.

Royal College of Anaesthetists

Royal College of Anaesthetists, Churchill House, 35 Red Lion Square, London WC1R 4SG
020 7092 1500 | www.rcoa.ac.uk/gpas | GPAS@rcoa.ac.uk