



Guidance on the provision of services for Neuroanaesthesia and Neurocritical Care

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

Summary

- Neuroanaesthesia should only take place in designated neuroscience centres.¹
- There should be sufficient numbers of clinical programmed activities in consultants' job plans to provide cover for all elective neurosurgical operating lists and interventional neuroradiology sessions, and also to provide adequate emergency cover.^{1,2}
- Staffing levels in the operating theatre should be sufficient to allow neuroanaesthetists to work in teams during long and complex operations.³
- There should be a designated consultant lead for neurocritical care and sufficient consultant sessions to provide daytime and out-of-hours cover.⁴
- There should be sufficient numbers of neurocritical care beds to allow timely access for patients from within an agreed geographical area. Management of critically ill patients outside the critical care unit should take place only in exceptional circumstances.⁴⁻⁶
- The care of head-injured patients is an integral part of neuroanaesthesia and neurocritical care. Units accepting head-injured patients must have specific arrangements in place, including evidence-based protocols, appropriately trained staff and sufficient resource to allow timely access for those requiring life-saving surgery.^{1,4,5,7-9}
- Protocols and appropriate facilities should be in place for transfer of critically ill neuroscience patients between hospitals, and within neuroscience units.^{10,11}
- There should be appropriate support facilities to allow delivery of a safe and high quality service.⁴

Introduction: The importance of neuroanaesthesia and neurocritical care services

Anaesthesia for neurosurgery – neuroanaesthesia – is based in recognised neuroscience centres, which allow the grouping together of the interrelated specialties required to support neurosurgery. These centres, whether they be in specialist, teaching or district general hospitals, should provide neurosurgical, neurological, neuroradiological and other supporting specialist and general services necessary for the management of patients with neurological disease.

The provision of adequate numbers of neurocritical care beds is a prerequisite for the delivery of such specialist services.

The centralisation of neuroscience practice is essential to ensure critical mass for delivery of efficient and high quality clinical care. The pace of development, and the scope of procedures being undertaken in neurosurgery and interventional neuroradiology, continues to increase the specialist nature of neuroanaesthesia and neurocritical care.

The clinical service should provide:

- ◆ anaesthesia for neurosurgery – intracranial, complex spinal and associated surgery

- ◆ anaesthesia for neuroradiology – diagnostic and interventional procedures
- ◆ neurocritical care – pre- and post-operative management of complex elective cases and the management of critically ill patients, such as those with severe head injury, intracranial haemorrhage, severe neurological disease and those who develop systemic complications secondary to their neurological condition.

Levels of provision of service

1 Staffing requirements

Neuroanaesthesia

- 1.1 The organisation of cover for neuroanaesthesia and neurocritical care requires a specific group of consultant anaesthetists (neuroanaesthetists) who may be part of, or closely affiliated with, a general department of anaesthesia and intensive care. A neuroanaesthesia service requires adequate provision of consultant programmed activities to support elective and emergency workload.
- 1.2 There should be immediate availability of a resident anaesthetist for 24 hours each day, to manage post-operative and emergency patients. In neuroscience units with a substantial caseload, this will require the provision of a resident anaesthetist dedicated to this group of patients. Out-of-hours, consultants should be available for immediate telephone advice and be able to attend the hospital within 30 minutes.
- 1.3 There should be sufficient programmed activities to ensure consultant cover of all neurosurgical operating lists and interventional neuroradiology sessions. Adequate arrangements for cross covering annual and study leave should be incorporated into consultants' job plans. Adequate consultant cover is also required to provide general anaesthesia and sedation for diagnostic radiology sessions, including CT and MRI scans.
- 1.4 Consultants working in neuroanaesthesia should have sufficient regular programmed activities within this field to ensure that their specific skills and experience are maintained. A minimum of one day per week is likely to be required to fulfil this requirement.
- 1.5 Allocation of a single neuroanaesthetist to an operating list with long neurosurgical cases is insufficient and a team of anaesthetists should service long and complex operations. Comprehensive hand-over arrangements must be in place to ensure continuity of care during long cases.

Neurocritical care

- 1.6 The Royal College of Nursing suggests that the nurse:patient ratio for a patient requiring Level 3 and Level 2 care should be 1:1 and 1:2 respectively, but the actual nursing establishment to support neurocritical care services may be higher. It may not be possible to leave Level 2 patients with neurological disorders alone even when they are physiologically normal, and an allowance to cover the need for closer supervision of such patients should be made when calculating the nursing establishment.
- 1.7 Allied health professionals are key members of the multi-professional team and a sufficient establishment is crucial to the delivery of high quality neurocritical care services.
- 1.8 Consultants responsible for the care of neuroscience patients requiring critical care support should have the knowledge, skills and experience needed to treat this group of patients, irrespective of whether the services are provided in a dedicated neurocritical care unit or within the context of a general intensive care unit. There should be a designated lead consultant for neurocritical care (or director of neurocritical care) and this consultant should have programmed activities allocated to this function.
- 1.9 Although the management of patients requiring neurocritical care is closely shared with the neurosurgical team, a minimum of 10 daytime clinical consultant programmed activities is required to cover a small neurocritical care unit (4–8 beds). In larger units it may be necessary for two consultants to be available during weekdays for all or part of the day. However, the consultant establishment for neurocritical care should be reviewed locally so that it reflects local conditions, including the skill mix of other members of the multi-professional team. It has been recommended that, in large and busy units, there may be a requirement for up to 30 consultant programmed activities per week.⁴
- 1.10 In large units it may be appropriate to allocate consultant programmed activities to provide support to patients throughout the hospital via an outreach service.
- 1.11 There should be a resident doctor with appropriate skills and competencies immediately available for neurocritical care 24 hours each day.
- 1.12 Staffing levels must be sufficient to enable an appropriately qualified and experienced doctor and trained assistant to accompany critically ill patients during transfer between neurocritical care and operating theatres, CT and MRI scanners and angiography suites.

2 Equipment, support services and facilities

Equipment

2.1 There is a high incidence of difficult intubation in neurosurgical units carrying out complex cervical spinal surgery. Specific equipment to manage the difficult airway, including the provision of sufficient numbers of fibre-optic laryngoscopes, should be available.

Support services

2.2 The demand for critical care beds in neuroscience centres is high and the actual number and configuration of Level 3 and Level 2 beds should be determined locally. However, capacity should be sufficient to allow access by critically ill patients in an appropriate time scale, e.g. within 4 hours for those who require life-saving surgery. The Society of British Neurological Surgeons recommends the provision of 10 designated Level 2 and level 3 beds per million population for neurosurgical patients, and the Association of British Neurologists additionally estimates that between 5–7 neurocritical care beds per million population are required to support the care of neurology patients.^{4–6}

2.3 A 24-hour acute pain service should be provided for post-operative neurosurgical patients.

2.4 24 hours a day neuroradiology support should be provided for interpretation of neuro-imaging. On-line review of CT scans from referring hospitals and within the neuroscience centre should be available locally, and consideration should be given to the provision of such access in the homes of consultants who provide cover to neurocritical care out-of-hours.

2.5 There should be on-site laboratory provision, or point of care testing, for arterial blood gases, serum electrolytes and activated clotting time, to allow safe management of patients in the operating theatre, during endovascular procedures and on the neurocritical care unit.

2.6 Rapid access to other biochemical and haematological investigations, blood transfusion and cerebrospinal fluid (CSF) microscopy should also be provided.

2.7 Expert neuropathological expertise should be available on request, with the ability to carry out 'frozen section' examinations on site.

2.8 Pre-admission clinics for elective neurosurgery should be available with input from the department of neuroanaesthesia.

2.9 For stand-alone neuroscience centres, local arrangements should be in place for specialist

opinion and review of patients by other disciplines. Named consultants should be identified in 'core' specialties to facilitate such liaison. There should be same day availability of cardiac echo investigations (including transoesophageal echo) and ultrasound scanning. To avoid the transfer of critically ill patients, this should be provided at the bedside for patients on the neurocritical care unit.

Guidelines

2.10 Neurocritical care outcome can be improved by the delivery of management guidelines based on expert consensus. All members of the neurocritical care multi-professional team should input to the development of local protocols, which should cover all the common pathologies managed by that unit. Protocols for the management of severe head injury are particularly important and guidance for management in the acute phase should be developed in collaboration with clinicians from referring hospitals.

2.11 Local guidelines should be agreed between clinicians in the neuroscience unit and referring hospitals for transfer of patients, and audited as a routine.

Facilities

2.12 Critically ill patients often require transfer to and from the operating theatre, CT and MRI scanners and angiography suites. Theatres, ICU and radiological facilities should therefore be in the closest possible proximity and preferably on the same floor. Adequate provision should be made for monitoring patients during such transfer. Local guidance should be developed for the intra-hospital transfer of critically ill neuroscience patients, based on guidance from the Intensive Care Society.¹¹

3 Areas of special requirement

Children

3.1 Children requiring neurosurgery need specific arrangements. Whilst specialist paediatric neurosurgical units exist, many children are treated in adult neuroscience centres. However, paediatric neurosurgeons and anaesthetists should be involved in the management of children requiring neurosurgical intervention wherever that care is delivered. In providing neuroanaesthesia for children, appropriate planning is necessary and this might include shared responsibility between neuroanaesthetists and paediatric anaesthetists.

3.2 All children under the age of 16 requiring neurocritical care should be managed in a paediatric intensive care unit.

3.3 Detailed guidance for the management of children has been issued and applies equally to

those requiring neurosurgical intervention (see Chapter 8: Guidance on the provision of paediatric anaesthesia services).

4 Training and education

- 4.1** The specialist nature of neuroanaesthesia dictates that it is a consultant-delivered specialty. Trainees receive only a limited exposure based on a clinical attachment during years 1 or 2 of training, with some having longer attachments forming part of years 3–5. Because of the limited time that trainees spend on neuroanaesthesia attachments, each department should develop structured training programmes to cover all core topics. Trainees should also be encouraged to attend other training opportunities within the neuroscience unit, such as grand rounds, and radiology and pathology case conferences and mortality and morbidity meetings.
- 4.2** Fellowship posts should be identified to allow additional training for those who wish to follow a career in neuroanaesthesia or neurocritical care. These should be suitable for trainees who wish to take time out of training programme or for those who are post-CCT. Such posts should provide similar or enhanced levels of teaching, training and access to study leave as regular training posts.

5 Research and audit

- 5.1** Departments of neuroanaesthesia and neurocritical care should be encouraged to develop research interests, even if not part of an academic department. Research collaboration with other neuroscience disciplines is good practice.
- 5.2** Audit programmes should be developed locally but should include continuous audit of transfer of brain-injured patients, neurocritical care capacity and demand, rates of readmission to ICU and caseload of trainees. In general, local practice should be audited against national and expert consensus guidelines.

6 Organisation and administration

- 6.1** Much of neurosurgery involves acute work with a high degree of urgency. The provision of associated services must recognise this need and inappropriate delay cannot be allowed to occur due to the lack of key personnel or facilities. Laboratory services, neuroradiology and availability of operating theatre time must all be organised to cope with these demands.
- 6.2** Departments of neuroanaesthesia and neurocritical care, even if part of a large general department, must be provided with adequate secretarial

and administrative support. Consultants with lead responsibility for neuroanaesthesia and neurocritical care should have programmed activities allocated to this function. Appropriate levels of administrative support, including data collection and analysis, should be available for neurocritical care.

- 6.3** Consultants in neuroanaesthesia and neurocritical care should be involved in the planning of neuroscience services at a local and regional level.
- 6.4** A lead consultant responsible for patient transfer should be identified both in the neuroscience unit and in referring hospitals.

7 Patient information

- 7.1** Each department should provide written information specific to neurosurgical procedures, including relevant risks. Information for relatives of patients requiring neurocritical care should also be available, including contact details of relevant charities and helplines.

References

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