Chapter 18
Guidelines for the Provision of Anaesthesia Services (GPAS)
Guidance on the Provision of Cardiac and Thoracic Anaesthesia Services 2016

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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

1.1 Each cardiothoracic unit must have consultant anaesthetists with dedicated, individual responsibility for cardiac and thoracic anaesthetic services.

1.2 Minimum staffing levels to provide 24-hour consultant cover for theatres and the intensive care unit should comply with published guidance. Cardiothoracic intensive care may be provided by dedicated intensivists, or by cardiothoracic anaesthetists with the necessary competencies, depending on staffing structure in individual units.

1.3 Minimum monitoring during bypass must conform to the standards recommended by the joint working group of the Society of Clinical Perfusion Scientists, Association of Cardiothoracic Anaesthetists and Society of Cardiothoracic Surgeons.

1.4 Post-operative recovery facilities for cardiac surgery should be appropriately staffed and equipped, ring-fenced, and located close to the theatres.

1.5 In cardiothoracic units, there must be immediate access to critical care facilities, which must be staffed by appropriately trained personnel.

1.6 There must be appropriate support facilities provided on site for cardiothoracic units, including perfusion services, transoesophageal echocardiography, blood transfusion services, microbiology, pharmacy, pathology, respiratory function testing and radiological services. Staff who deliver these services must be trained to the appropriate level of competence. These must be backed up by modern information technology and archiving systems.

1.7 Special provision of staff, environment, facilities and services must be made for children undergoing cardiac or thoracic procedures.

1.8 Patients who have undergone thoracic procedures must be managed in dedicated thoracic units post-operatively, with access to an acute-pain service and governed by pain-relief protocols.

1.9 Consultant anaesthetists providing anaesthesia for cardiac or thoracic surgery are expected to maintain the individual competencies recommended by the Royal College of Anaesthetists. Evidence of continuing educational and professional development will be necessary to demonstrate fitness to practise in this specialty.

1.10 Anaesthetic trainees attached to the cardiac or thoracic unit should be of appropriate seniority to benefit from higher training in this area. An anaesthetist training in cardiothoracic anaesthesia should be supervised at all times by an appropriately trained consultant or specialist.

1.11 All cardiothoracic units must participate in local and national audit.

1.12 Patients receiving anaesthesia for cardiac or thoracic procedures should be provided with written information regarding their surgery and peri-operative care.
Introduction: the importance of cardiac and thoracic anaesthesia services

- Cardiac anaesthetic services are provided for patients undergoing cardiac and thoracic vascular investigations and surgery.

- Cardiac surgery may involve adult, paediatric and neonatal patients and includes all forms of open and closed heart surgery, whether elective or emergency. It also includes some interventional cardiological procedures, more commonly performed in children, but increasingly also performed in adults, such as percutaneous atrial septal defect and patent foramen ovale closure, transcatheter aortic valve implantation, and ablation procedures for complex cardiac dysrhythmias. Some complex procedures are increasingly performed in hybrid operating rooms, where radiological imaging and conventional operating theatres are combined. Cardiac surgery may also include heart or heart/lung transplantation, increasing use of ‘off-pump’ surgery (performed without cardiopulmonary bypass), and the use of ventricular assist devices to support the failing circulation for periods of days or weeks in the intensive care unit (ICU).

- Cardiac surgery is mainly carried out in specialist units within teaching hospitals or in specialist hospitals dedicated to cardiothoracic work.

- Many factors are influential in determining the viability of a cardiac surgical unit. However, the most important of these is clinical activity, based mainly on the yearly caseload of heart operations.

- The nature of cardiac surgery demands that all patients should be cared for post-operatively in a unit that conforms to the standards of general level 3 and 2 intensive care facilities.

- Good clinical practice in cardiac anaesthesia reduces the risks of adverse outcomes for the patient.

- Cardiac anaesthesia provides an important area of training for trainee anaesthetists. It offers training in the peri-operative care of patients with severe heart and lung disease, which is essential for all anaesthetists, whatever their future area of practice.

- Thoracic surgery in adults includes surgery on the lungs (including lung transplantation), pleura, thymus, oesophagus and other thoracic structures, as well as the chest wall. Thoracic procedures include lobar resection, pneumonectomy for malignant and non-malignant conditions, mediastinoscopy and mediastinotomy, and bronchoscopy for diagnostic and interventional indications. Video-assisted thoracoscopic surgery is also performed for drainage and investigation of effusions, lung resection, sympathectomy and removal of mediastinal tumours. Other procedures include surgical management of air-leaks, management of empyema, operations on the chest wall, endobronchial laser surgery and tracheal stenting.

- Anaesthesia for lung transplantation, although limited in the UK at present because of donor shortage, may sometimes require the use of cardiopulmonary bypass. There is also an expanding use of extracorporeal membrane oxygenation for acute lung injury.

- Although thoracic surgical units usually exist as part of a cardiothoracic service within a larger hospital, their needs may vary to some extent from those of pure cardiac units. New service specifications for thoracic surgery mean that in the near future, surgeons will not have mixed cardiac and thoracic practices. This may have implications for the organisation of anaesthetic services.
Levels of provision of service

1 Staffing requirements

Cardiac anaesthetic services

1.1 Each unit should have a designated lead consultant anaesthetist who is responsible for cardiac anaesthetic services. This should be recognised in their job plan and they should be involved in multidisciplinary service planning and governance within the unit.

1.2 A consultant cardiac anaesthetist must be available continuously, preferably through a dedicated cardiac anaesthetic on-call rota. Trained staff and appropriate facilities should be immediately available for emergency re-sternotomy. A suitably trained resident anaesthetist should be available for peri-operative emergencies.

1.3 Minimum staffing levels to provide 24-hour consultant anaesthetic cover for theatres should comply with published guidance. There should also be 24-hour consultant cover of the cardiac ICU.

1.4 The level of expertise and availability of anaesthetists and surgeons must be adapted to the evolving needs of the patient before and after surgery. In the early stages, this will require the immediate availability of anaesthetists, intensivists, and surgeons.

1.5 Two consultant anaesthetists, or a consultant and senior trainee, may be required for more complex procedures, such as thoraco-abdominal aneurysm repair.

1.6 Perfusion services must be provided by suitably trained and accredited perfusion scientists and comply with Department of Health guidelines.

1.7 Interventional cardiology services must take into account the likely impact on anaesthesia, intensive care and nursing resources according to patient acuity. General anaesthesia may be needed to facilitate complex interventions, or required in an emergency in the event of major complications during invasive cardiological procedures. Both eventualities require the provision of dedicated anaesthetic staffing, technical assistance, equipment and monitoring.

1.8 At centres where 24-hour primary percutaneous coronary interventions are performed, and in heart attack centres, which include out-of-hospital cardiac arrest patients, there must be provision for immediate availability of a dedicated resident anaesthetist, technical assistance and appropriate equipment and facilities.

Thoracic anaesthetic services

1.9 Each unit should have a designated lead consultant anaesthetist for thoracic services. This should be recognised in their job plan and they should be involved in multidisciplinary service planning and governance within the unit.

1.10 The complexity of the cases may necessitate additional sessional commitment for pre-operative visiting and assessment.

1.11 A consultant anaesthetist must be available continuously, preferably through a dedicated thoracic or cardiothoracic anaesthetic on-call rota, particularly if lung transplantation is performed.

1.12 It is essential that wherever thoracic anaesthesia and surgery are performed, there should be a resident anaesthetist and thoracic surgeon available.

1.13 The consultant anaesthetists in cardiothoracic units will be responsible for the provision of service, teaching, production of protocols, management, research and audit. Adequate sessional time will be required for these activities.
2 Equipment, support services and facilities

Equipment and monitoring

2.1 Cardiac anaesthesia and surgery are carried out under intensive physiological patient monitoring. Routinely used monitoring during cardiac surgery will include the following:\textsuperscript{15,16}

- in the induction/anaesthetic room: electrocardiogram (ECG); pulse oximetry; invasive and non-invasive blood pressure (BP) monitoring; respired gas monitoring
- during surgery: ECG; pulse oximetry; invasive pressure monitoring (systemic and pulmonary artery, and central venous pressures); respired gas monitoring; measurement of body core temperature. Transoesophageal echocardiography should be immediately available. Complex cases may require more sophisticated monitoring, such as cardiac output estimation or transcranial near-infra-red spectroscopy
- during the transfer of the patient at the end of surgery to the post-operative care unit: ECG; invasive BP; pulse oximetry; disconnection alarm for any mechanical ventilation system; fractional inspired oxygen concentration; end-tidal carbon dioxide.

2.2 Monitoring during cardiopulmonary bypass must conform to the standards recommended by the joint working group of the Society of Clinical Perfusion Scientists, Association of Cardiothoracic Anaesthetists, and Society of Cardiothoracic Surgeons.\textsuperscript{3} Provision of perfusion services must conform to Department of Health guidance.\textsuperscript{13}

2.3 Comprehensive monitoring facilities are also required for complex thoracic cases,\textsuperscript{14,15} for example, facilities for pulmonary artery catheterisation and measurement of cardiac output. For patients undergoing lung transplantation, additional facilities will be needed.

2.4 On ICU, equipment for a variety of methods of mechanical ventilation and circulatory support is required.\textsuperscript{2} Transthoracic and transoesophageal echocardiography should be immediately available. Staff who are competent in the delivery of advanced echocardiography must also be immediately available.

2.5 Facilities should be available for the decontamination and safe storage of transoesophageal echocardiography probes, in line with local and national recommendations. There should also be a method to archive and retrieve all echocardiography studies performed in cardiac theatres.

Facilities

2.6 Dedicated thoracic, cardiac or cardiothoracic wards are desirable.

2.7 Cardiac surgery must take place in dedicated cardiothoracic operating rooms. It is unlikely that an operating room will be kept available at all times for emergencies. It is preferable that all cardiac surgery and post-operative care be carried out in a dedicated environment whenever possible.

2.8 Many units care for selected cardiac surgical patients in the immediate post-operative period in facilities other than designated ICUs. These are variously referred to as the high-dependency unit (HDU), cardiac recovery or cardiac fast-track, or by another similar name. They have in common the aim of selecting patients and minimising the period of mechanical ventilation in the post-operative period. The patient monitoring and support requirements of such a facility are no less than the essential monitoring requirements of patients cared for in ICU, and the governance arrangements should also be the same. Agreed clinical criteria for the appropriate case mix cared for in these facilities must be in place. Suitably experienced anaesthetic and surgical staff must be immediately available. Service-line arrangements must be in place for immediate escalation to a level 3 ICU facility when complications arise. Patients would normally stay no longer than 24 hours in this facility and either progress to ward care or ICU care.

2.9 After major thoracic surgery, patients must be transferred to a properly equipped and staffed area. In the UK, most patients will return to an HDU. However, in some instances, for example, elderly patients who have had oesophageal surgery and some patients undergoing lung surgery, there may be a need for post-operative mechanical ventilation on ICU. Access to ICU or HDU is therefore essential. Nursing staff on ICUs and HDUs receiving patients after thoracic surgery should be trained in thoracic nursing care and have access to the same services that are available on a general thoracic ward.
2.10 There should be an appropriately sized, equipped and staffed post-anaesthetic recovery unit for those patients
who do not require HDU or ICU.

2.11 On rare occasions, when unexpected difficulties arise in thoracic surgery, access to cardiopulmonary bypass is
essential.

Support services
2.12 Haematology, blood transfusion and biochemistry services should be available with rapid access for both
cardiac and thoracic surgery. In cardiac surgery, there should be satellite or point-of-care laboratory facilities in
or near the operating room for the measurement of blood gases, electrolytes, haemoglobin and anticoagulation
(including platelet mapping, thromboelastography or thromboelestometry).

2.13 There should be immediate access to x-ray facilities, and computerised axial tomography and magnetic
resonance imaging services must be available for patients undergoing cardiac or thoracic surgery. For
cardiac patients, dedicated echocardiography equipment, including transoesophageal echo must be
immediately available in the operating suite and post-operative care areas. Those who deliver intra-operative
echocardiography services should be trained to the level of competence defined by the British Society
of Echocardiography and Association of Cardiothoracic Anaesthetists accreditation. The demand for
echocardiography services is likely to continue to increase in the future, especially for three-dimensional echo in
surgery for congenital cardiac conditions.

2.14 Access to measurements of respiratory function is required for patients undergoing thoracic surgery, including a
facility for pulmonary exercise testing.

2.15 Physiotherapy services are required during the pre-operative preparation and post-operative care of patients
undergoing cardiothoracic surgery.

2.16 Medical physics or other suitably qualified technicians are required to maintain, repair and calibrate anaesthetic
machines, mechanical ventilators, monitors, infusion equipment, the heart/lung machines, cooling/warming
devices and other machinery that may be essential, such as intra-aortic counter-pulsation balloon pump
equipment. Some specialised equipment may need to be maintained by contractual arrangement with an
external supplier.

2.17 For patients undergoing thoracic surgery, physicians and surgeons experienced in specialist non-thoracic areas,
such as cardiac and endocrine disease, should be available for consultation.

2.18 The provision of an acute pain service is necessary for thoracic surgery. Pain relief and clinical management
protocols must be clearly defined for thoracic and cardiac patients.

3 Areas of special requirement
3.1 Children undergoing thoracic surgery have special requirements and the responsibility for paediatric anaesthetic
care may be shared with paediatric anaesthetists.

3.2 Paediatric patients who have undergone cardiac surgery must be cared for in a unit designed and equipped to
care for paediatric patients, and staffed by appropriately trained nurses. Such a unit should meet the standards
laid down for paediatric intensive care, including adequate arrangements for retrieval and transfer.

3.3 Service provision for cardiac surgery in children and adults with congenital heart disease is currently under
review, with a proposed model of care and draft designation standards.
4 Training and education

4.1 Cardiac and thoracic anaesthesia is a ‘key unit of training’ for intermediate-level training in anaesthesia. Trainee anaesthetists must be of appropriate seniority to be able to benefit from this area of training, at least specialist trainee year 3 or above.

4.2 Consultant anaesthetists intending to undertake anaesthesia for cardiac or thoracic surgery should have received training to higher level in adult intensive care and adult cardiac and/or thoracic anaesthesia, for a minimum of one year in recognised training centres, as part of general training. Those providing intensive care for cardiac surgical patients should have received training to the minimum level as defined by the Faculty of Intensive Care Medicine special skills year in cardiothoracic intensive care.

4.3 An anaesthetist training in cardiothoracic anaesthesia should be supervised at all times by an appropriately trained consultant, and normally should not be expected to supervise other trainees in theatre.

4.4 The number of centres that perform thoracic surgery is decreasing. It is therefore essential that the training opportunities for anaesthetists, nursing staff, physiotherapists and other staff are used to the maximum, and that teaching and training in thoracic anaesthesia are given a high priority.

5 Research, audit, and governance

5.1 Most research in cardiothoracic anaesthesia will be undertaken in specialist cardiothoracic units and must be given high priority.

5.2 Regular clinical audit of the work of cardiothoracic units and cardiothoracic anaesthesia is essential. This includes the participation of anaesthetists in the multidisciplinary team pre-operative assessment meeting.

5.3 All cardiothoracic units should have regular morbidity and mortality meetings. These should have a list of patients to discuss in advance, an attendance register and minutes with learning points. Consultant anaesthetists should attend these meetings and trainees should be encouraged to attend during their attachments.

5.4 Robust procedures should be in place to report and investigate adverse incidents to staff or patients.

6 Organisation and administration

6.1 Perfusion services must be included in a clinical directorate or equivalent, under the managerial control of a consultant, who may be a consultant anaesthetist.

6.2 Clinical protocols should be developed from national guidelines and reviewed on a regular basis.

7 Patient information

7.1 Booklets providing information for patients about their stay in hospital should be available for all patients. This will include the patient information booklets published by the British Heart Foundation on cardiac disease, prevention, treatment and lifestyle modification, and information on the anaesthetic.

7.2 Information about cardiac rehabilitation generally, and information regarding the availability of such courses locally, should also be available.
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References

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