



# Guidance on the provision of Cardiac and Thoracic Anaesthesia Services

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

- Each cardiothoracic unit must have consultant anaesthetists with dedicated, individual responsibility for cardiac and thoracic anaesthetic services.
- Minimum staffing levels to provide 24-hour consultant anaesthetic cover for theatres and ICU would equate to nine full-time equivalent consultant cardiac anaesthetists for 1,200 adult cardiac operations per year.<sup>1</sup>
- Minimal 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.<sup>2-6</sup>
- Post-operative recovery facilities for cardiac surgery should be appropriately staffed and equipped, ring-fenced and located close to the theatres.<sup>1,5,6</sup>
- In cardiothoracic units, there must be immediate access to critical care facilities, which must be staffed by appropriately trained personnel.<sup>1</sup>
- There must be appropriate support facilities provided on site for cardiothoracic units including perfusion services, blood transfusion services, microbiology, pharmacy, pathology, respiratory function testing and radiological services. These must be backed up by modern information technology (IT) systems.<sup>1</sup>
- Special provision of staff, environment, facilities and services must be made for children undergoing cardiac or thoracic procedures.<sup>7</sup>
- Patients who have undergone thoracic procedures must be managed in dedicated thoracic units post-operatively with access to an acute pain service and pain relief protocols.
- Consultant anaesthetists providing anaesthesia for cardiac surgery are expected to maintain the individual competencies recommended by the Royal College of Anaesthetists.<sup>8</sup> Evidence of continuing educational and professional development will be necessary to demonstrate fitness to practise in this specialty.
- Anaesthetic trainees attached to the cardiac or thoracic unit should be of appropriate seniority to benefit from higher training in this area and an anaesthetist training in cardiothoracic anaesthesia should be supervised at all times by an appropriately trained consultant or specialist.<sup>8</sup>
- All cardiothoracic units must participate in local and national audit.<sup>9</sup>
- Patients receiving anaesthesia for cardiac or thoracic procedures should be provided with written information regarding the surgery and peri-operative care.<sup>10-13</sup>

## Introduction: The importance of anaesthetic services for cardiac surgery

- 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 in adults, such as percutaneous atrial septal defect (ASD) and patent foramen ovale (PFO) closure and ablation of aberrant pathways causing complex dysrhythmias. It also includes heart or heart/lung transplantation, increasing use of 'off-pump' surgery (performed without cardiopulmonary bypass), and the use of ventricular assist devices (VADs) 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 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 which conforms to the standards of general Level 3 and 2 intensive care facilities.
- Evidence suggests that clinical excellence in cardiac anaesthesia has an important influence on outcome.
- 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, essential for all anaesthetists whatever their future area of practice.

## The importance of anaesthetic services for thoracic surgery

- Thoracic surgery in adults includes surgery to 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 (VATS) 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 due to donor shortage, may sometimes require the use of cardiopulmonary bypass. There is also an expanding use of extracorporeal membrane oxygenation (ECMO) for acute lung injury (ALI).
  - 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.

## Levels of provision of service

### 1 Staffing

#### Cardiac anaesthetic services

- 1.1 Each unit should have a consultant anaesthetist who is responsible for cardiac anaesthetic services.
- 1.2 24-hour consultant anaesthetist availability is required, preferably with a dedicated cardiac anaesthetic on-call rota.
- 1.3 Minimum staffing levels to provide 24-hour consultant anaesthetic cover for theatres and the ICU would be nine full-time equivalent consultant cardiac anaesthetists for 1,200 adult cardiac surgery operations per year.<sup>1</sup>
- 1.4 The level of expertise and availability of anaesthetist and surgeon must be adapted to the evolving needs of the patient following surgery. In the early stages this will require the immediate availability of both anaesthetist and surgeon.
- 1.5 Perfusion services must be provided by suitably trained and accredited perfusion technicians.<sup>2</sup>
- 1.6 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 anaesthetic staffing, assistance, equipment and monitoring.

### Thoracic anaesthetic services

- 1.7 Each unit should have a designated lead consultant for thoracic services.
- 1.8 The complexity of the cases may necessitate additional sessional commitment for pre-operative visiting and assessment.
- 1.9 Two anaesthetists may be required for more complex procedures.
- 1.10 24-hour consultant anaesthetic availability is required, preferably with a designated thoracic on-call rota, particularly if lung transplantation is performed.
- 1.11 It is essential that wherever thoracic anaesthesia and surgery are performed, there should be a resident anaesthetist and thoracic surgeon.
- 1.12 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, facilities, environment and support services

### Equipment and monitoring

- 2.1 Cardiac anaesthesia and surgery are carried out under intensive physiologic patient monitoring. Routinely used monitoring during cardiac surgery will include the following:
  - 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 monitoring of arterial including pulmonary artery and central venous pressures; measurement of body core temperature. Transoesophageal echocardiography should be immediately available.
  - During the transfer of the patient at the end of surgery to post-operative care unit: ECG; invasive BP; pulse oximetry; disconnection alarm for any mechanical ventilation system; fractional inspired oxygen concentration; and 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.<sup>2</sup>

- 2.3 On ICU, equipment for a variety of methods of mechanical ventilation is required.
- 2.4 Comprehensive monitoring facilities are required. For complex thoracic cases, facilities for pulmonary artery catheterisation and cardiac output measurement are required. For patients undergoing lung transplantation, additional facilities will be needed.

### Facilities

- 2.5 A dedicated thoracic or cardiothoracic ward is desirable.
- 2.6 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 be carried out in a dedicated environment whenever possible.
- 2.7 Many units care for selected cardiac surgical patients in the immediate post-operative period in facilities other than designated ICUs. These may be called high dependency unit (HDU), cardiac recovery, cardiac fast-track or by another similar name. They have in common the aim of selecting patients and minimising or abolishing the period of mechanical ventilation in the post-operative period. The patient monitoring requirements of such a facility are no less than the essential monitoring requirements of patients cared for in ICU.
- 2.8 After major thoracic surgery, patients must be transferred to a properly equipped and staffed area. In the United Kingdom most patients will return to an HDU. However, in some instances, e.g. 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 that receive patients who have had thoracic surgery should be trained in thoracic nursing care and have access to the same services that are available on a general thoracic ward.
- 2.9 There should be an appropriately sized, equipped and staffed post-anaesthetic recovery unit for those patients who do not require HDU or ICU.
- 2.10 On rare occasions, when unexpected difficulties arise in thoracic surgery, access to a cardiopulmonary bypass facility is essential.

### Support services

- 2.11 Haematology, blood transfusion and biochemistry services should be available with rapid access

for both cardiac and thoracic surgery. In cardiac surgery, wherever possible, 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.

- 2.12** There should be immediate access to X-ray facilities, and computerised axial tomography (CT) and Magnetic Resonance Imaging (MRI) services must be available for patients undergoing cardiac or thoracic surgery. For cardiac patients, dedicated echocardiography equipment, including trans-oesophageal echo (TOE) should be available in the operating suite. The demand for echocardiography services is likely to increase considerably in the future.
- 2.13** Access to respiratory function measurements is required for patients undergoing thoracic surgery, including facility for pulmonary exercise testing.
- 2.14** Physiotherapy services are required during the pre-operative preparation and post-operative care of patients undergoing thoracic surgery.
- 2.15** 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.
- 2.16** 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.
- 2.17** 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.<sup>7</sup>
- 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.<sup>7</sup>

### 4 Training and education

- 4.1** Cardiac and thoracic anaesthesia is a 'Key unit of training' for Intermediate Level Training in anaesthesia.<sup>8</sup> Trainee anaesthetists must be of appropriate seniority to be able to benefit from this area of training, i.e. specialist trainee year 3 or above.
- 4.2** Anaesthetists intending to undertake anaesthesia for cardiac or thoracic surgery should have received background training to higher level in adult intensive care, adult cardiac and/or thoracic anaesthesia in recognised training centres as part of general training.<sup>8</sup>
- 4.3** An anaesthetist training in cardiothoracic anaesthesia should be supervised at all times by an appropriately trained consultant, and should not normally be expected to supervise other trainees in theatre.
- 4.4** The number of centres which 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 Organisation and administration

- 5.1** Perfusion services must be included in a medical directorate or equivalent, under the managerial control of an NHS consultant who may be a consultant anaesthetist.
- 5.2** Clinical protocols can be developed from national guidelines and reviewed on a regular basis.

### 6 Research and audit

- 6.1** Most research in thoracic anaesthesia will be done in specialist thoracic units and must therefore be given high priority.
- 6.2** Regular clinical audit of the work of cardiac units and cardiac anaesthesia is essential.

### 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.<sup>10-13</sup>
- 7.2** Information about cardiac rehabilitation generally, and information regarding the availability of such courses locally, should also be available.

## References

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- 11 Raising the standard: information for patients. *RCoA*, London 2003 ([www.rcoa.ac.uk/index.asp?PageID=126](http://www.rcoa.ac.uk/index.asp?PageID=126)).
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