Royal College of Anaesthetists

Chapter 18

Guidelines for the Provision of Anaesthesia Services (GPAS)

Guidance on the Provision of Anaesthesia Services for Cardiac Procedures 2023

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Chapter 18
Guidelines for the Provision of Anaesthesia Services for Cardiac Procedures 2023

Aims and objectives

The objective of this chapter is to promote current best practice for service provision in cardiac anaesthesia services. 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 cardiac anaesthesia services 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 cardiac anaesthesia services 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 these services.

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 cardiac anaesthesia services. 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 cardiac anaesthesia, including (but not restricted to) consultant anaesthetists, staff grade, associate specialist and specialty (SAS) anaesthetists, anaeasthesia associates, anaesthetists in training, operating department practitioners (ODPs) and nurses.

Target population

All ages of patients undergoing cardiac anaesthesia.

Healthcare setting

All settings within the hospital in which cardiac anaesthesia is provided.

Clinical management

Key clinical issues that will be covered:

Key components needed to ensure provision of high quality anaesthetic services for cardiac procedures.

Areas of provision considered:

- levels of provision of service, including (but not restricted to) staffing, equipment, support services and facilities
- areas of special requirement, such as paediatric patients, critically ill patients, pregnant patients, and cardiac catheter laboratories
- training and education
- research and audit
- organisation and administration

- patient information.

Exclusions

Provision of cardiac anaesthesia services provided by a specialty other than anaesthesia.

Clinical guidelines specifying how healthcare professionals should care for patients.

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

Cardiac anaesthesia services are provided for patients undergoing cardiac procedures. To reflect current practice, these guidelines have been more clearly divided to identify areas of differing requirement. Anaesthetists in cardiac surgical services are now more frequently required to provide anaesthesia for invasive cardiology procedures. Intraoperative transoesophageal echocardiography (TOE) is a specialist skill that cardiac anaesthetists are trained in and use to guide diagnostic and therapeutic decision-making in surgery.

Cardiac surgery may involve adult, paediatric and neonatal patients and includes many forms of open, closed and minimally invasive heart surgery, both elective and emergency. Some complex procedures are increasingly performed in hybrid operating rooms, where operating theatres have enhanced radiological imaging facilities. Cardiac surgery may also include heart or heart and lung transplantation, and the implantation of ventricular assist devices to support patients with acute and advanced heart failure, and extracorporeal membrane oxygenation (ECMO) services, both veno-venous (VV) and veno-arterial (VA), and in addition, mobile retrieval ECMO services.

There are a number of different unit models for delivery of cardiac surgery: large standalone tertiary centres with supraregional services, units in large multispecialty university centres and smaller units in a large general hospital setting. The degree of specialisation of the anaesthetists and their job plans are likely to reflect this setting.

Cardiac anaesthetists should be integrated into the multidisciplinary nature of each cardiac unit and take an active part in shaping services and analysing quality. Cardiac anaesthetists frequently have critical care cover in their job plans, which may assist integration of services. Patient mortality and morbidity audit data is in the public domain for each unit. Each surgeon and anaesthetist should have an understanding of how their own role contributes to patient in-hospital mortality outcomes.[1]

The nature of cardiac surgery demands that all patients should be cared for postoperatively in a unit that conforms to the standards of Level 2 or 3 critical care facilities. Patients may frequently have complications and require rapid escalation of the level of care. Anaesthesia and critical care services should work together to ensure that these services are flexible and responsive to the needs of the patients.

Cardiac anaesthesia provides an important area of training for trainee anaesthetists. It offers training in the perioperative care of patients with severe heart disease that is essential for all anaesthetists, whatever their future area of practice.

Recommendations

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

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1 Staffing requirements

1.1 Availability of two consultant anaesthetists, or a consultant and senior trainee or SAS doctor should be considered for more complex procedures, such as thoracoabdominal aortic aneurysm repair or acute Stanford Type A aortic dissections.[2]

1.2 Continuity of care should be a priority in prolonged cases and when this is not possible, a formal documented process with some overlap should be in place for handover of clinical care from one anaesthetist to another.[3]

1.3 The complexity of some cases may necessitate anaesthetic involvement in multidisciplinary team meetings and this activity should be reflected in job plans.

1.4 Consultant or autonomously practicing anaesthetists in cardiac units should be responsible for the provision of service, teaching, protocol development, management, research and quality improvement. Adequate time should be allocated in job plans for these activities.

1.5 Each unit should have a designated clinical lead (see glossary) anaesthetist who is responsible for cardiac anaesthesia services. This should be recognised in their job plan and they should be involved in multidisciplinary service planning and governance within the unit.

1.6 An appropriately trained consultant or autonomously practicing cardiac anaesthetist should be wholly and exclusively available at all times, through a formal on-call rota.[4] The out of hours duties of the on-call consultant or autonomously practicing cardiac theatre anaesthetist should cover only cardiac emergencies, as these can arise and escalate very rapidly particularly in tertiary referral units. On-call cardiac intensive care consultants or autonomously practicing anaesthetists should be trained in and provide support and cover for critical care emergencies such as out of hours diagnostic TOE.

1.7 Trained anaesthetic assistance, theatre staff and appropriate facilities should be immediately available for emergency resternotomy and cardiopulmonary bypass. A suitably trained resident anaesthetist should be immediately available for theatre emergencies and to assist the on-call consultant or autonomously practicing cardiac anaesthetist in theatre out of hours.[5]

1.8 Appropriate local arrangements should be made for the care of postoperative surgical patients being managed outside the main cardiac intensive care unit (ICU), for example postoperative recovery areas and wards.[6]

1.9 Perfusion services should be provided by suitably trained and accredited clinical perfusion scientists[7] and comply with Department of Health guidelines.[8] A suitable number of trained perfusionists should be always available according to the Recommendations for standards of monitoring during cardiopulmonary bypass. *ACTACC and SCTS*, 2022[7]

1.10 Interventional cardiology services increasingly require anaesthesia, critical care, perfusion, ODP and nursing resources depending on procedural complexity and patient morbidity. General anaesthesia may be needed to facilitate complex interventions or required in an emergency for invasive cardiological procedures. Both eventualities require that appropriate anaesthetic staffing, skilled assistance, equipment and monitoring should be available.[2]

1.11 At centres where 24/7 primary percutaneous coronary interventions are performed, and in designated heart attack centres, which include out of hospital cardiac arrest patients, there should be provision for immediate availability of a resident anaesthetist, skilled assistance and appropriate equipment and facilities.

2 Equipment, services and facilities

Equipment and monitoring

2.1 The same level of equipment should be available for cardiac surgery as is available in general theatres as specified in chapter 3. Additional specialty specific monitoring is required and is detailed below.[9]

2.2 The standard of monitoring in the operating theatre should allow the conduct of safe anaesthesia for surgery as detailed by the Association of Anaesthetists standards of monitoring.[10]

2.3 During the transfer of the patient at the end of surgery to the postoperative care unit there should be access to electrocardiogram (ECG), invasive blood pressure monitoring, pulse oximetry, disconnection alarm for any mechanical ventilation system, fractional inspired oxygen concentration, and end-tidal carbon dioxide.[10]

2.4 Access to cardiac output monitoring should be available for high risk cardiac cases perioperatively.[11]

2.5 Physiological monitoring alarm settings should be appropriate for the specific procedure.[12]

2.6 A fluid warmer allowing the transfusion of warmed blood products and intravenous fluids should be available and used.[13]

2.7 A rapid infusion device should be available for the management of major haemorrhage.[13]

2.8 A cell salvage service should be available for cases where massive blood loss is anticipated and for patients who decline blood products. Staff who operate this equipment should receive training and use it frequently to maintain their skills.

2.9 A dedicated ultrasound machine must be present in each cardiac theatre for the placement of vascular catheters.[14]

2.10 Cardiac anaesthesia and surgery are carried out under intensive physiological patient monitoring. Equipment used routinely for monitoring during cardiac surgery should be available. This includes invasive pressure monitoring for both systemic arterial, central venous and pulmonary artery pressures.[10,14]

2.11 Transoesophageal echocardiography must be immediately available.[15,16]

2.12 Complex cases may require additional monitoring, such as pulmonary arterial pressure monitoring and measurement of cardiac output. Facilities for on bypass haemofiltration should be available. This may also include cytokine haemadsorption filters in patients with higher inflammatory burden. [10,17]

2.13 Noninvasive cerebral monitoring should include depth of anaesthesia monitors and cerebral near-infrared spectroscopy.[10,17]

2.14 Monitoring during cardiopulmonary bypass should conform to the standards recommended by the joint working group of the Society of Clinical Perfusion Scientists of Great Britain and Ireland, Association for Cardiothoracic Anaesthesia and Critical Care (ACTACC), and Society for Cardiothoracic Surgery in Great Britain and Ireland and the European Guidelines on Cardiopulmonary Bypass in Adult Cardiac Surgery.[7,18]

2.15 An intraaortic counter pulsation balloon pump should be available.[19]

2.16 ECMO services may be available for post cardiotomy weaning off cardiopulmonary bypass.

2.17 Equipment for temporary pacing, including external pacing pads and emergency defibrillation must be available.

Facilities

2.18 A designated cardiac step-down unit and cardiac ward should be considered.

2.19 Cardiac surgery must be performed in dedicated operating rooms. It is unlikely that an operating room will be kept available at all times for emergencies. Local arrangements for urgent and emergency cases should be in place.

2.20 In some centres, selected cardiac surgical patients are managed in facilities other than designated ICUs following surgery. These are variously referred to as the high dependency unit (HDU), cardiac recovery or cardiac fast-track unit. These areas aim to minimise the period of mechanical ventilation and improve outcomes. The equipment, monitoring and staffing requirements for such a facility are no less than the requirements of patients cared for in Level 3 ICU. Agreed clinical criteria for the appropriate case mix should be in place. Suitably experienced anaesthetic and surgical staff should be immediately available. Arrangements should be in place for escalation to a Level 3 ICU facility as required.[6]

2.21 Facilities should be available for the decontamination and safe storage of transoesophageal echocardiography probes in line with local and national recommendations.[20,21,22] There should also be a method to report, archive and retrieve all echocardiography studies performed in cardiac theatres. Major complications related to transoesophageal echocardiography should be monitored.[23]

2.22 Cardiac units should consider the implementation of an enhanced recovery after surgery (ERAS) programme.[24,25]

Support services

2.23 Where possible, point of care or near patient testing should be used for blood gas analysis, measurement of electrolytes and blood sugar, haemoglobin, lactate and coagulation. This should include platelet function testing , thromboelastography or rotational thromboelastometry and early acute kidney injury urinary markers.[26] The need for direct oral anticoagulant (DOAC) analysis at point of care could be carefully considered.[27]

2.24 Immediate access to expert haematology advice, haematology laboratory services and blood products and factor replacements should be available.

2.25 There should be immediate access to expert radiology advice, x-ray facilities and computerised axial tomography services for patients undergoing cardiac surgery.

2.26 Access to measurements of respiratory function should be available for patients undergoing cardiac surgery, including a facility for cardiopulmonary exercise testing.

2.27 Physiotherapy services must be available during the preoperative preparation and postoperative care of patients undergoing cardiac surgery.

2.28 All anaesthetic equipment must be checked before use in accordance with the Association of Anaesthetists published guidelines. Anaesthetic machine checks should be recorded in a log and on the anaesthetic chart.[28]

2.29 Pain relief protocols should be clearly defined for cardiac surgery patients.

2.30 For cardiac patients, dedicated echocardiography equipment, including transoesophageal echo should be immediately available in the operating suite and postoperative care areas. Those who deliver intraoperative echocardiography services should be trained to the level of competence defined by specialist bodies.[29,30,31]

2.31 There should be access to a range of specialist cardiology services.[32]

2.32 24/7 access to cardiac electrophysiology services should be available.

3 Areas of special requirement

Children

3.1 Children with congenital heart disease undergoing cardiac procedures have special requirements and care should be provided by appropriately trained paediatric cardiac anaesthetists.[33,34]

3.2 Paediatric cardiac surgical patients should be cared for in a unit designed and equipped to care for paediatric patients and staffed by appropriately trained nurses. There should be facilities and staffing to support parents/carers accompanying children in the an aesthetic environment. Such a unit should meet the standards defined for paediatric critical care, including adequate arrangements for retrieval and transfer of patients[34].[35]

3.3 Anaesthetists should be aware of legislation and good practice guidance[36] relevant to children and according to the location in the UK.[37,38,39,40] These documents refer to the rights of the child, child protection processes and consent. Local arrangements for training should be implemented.

Adult congenital heart disease patients

This group comprises adult patients who have had cardiac disease diagnosed in childhood; those who present with a new primary diagnosis of congenital heart disease; and patients requiring heart surgery for the failures or complications arising from the prior interventional management of congenital cardiac lesions.[41]

3.4 Children currently transition to adult congenital heart disease services at the age of 16–18 years, although transition services are integrated into the care pathway from age 12 years. Anaesthetists should be aware of legislation and good practice guidance relevant to young and vulnerable adults.[36,42]

3.5 Specialist anaesthetists should be involved in the discussion of referrals and planning when this is conducted in the setting of a multidisciplinary team. This should be recognised in job plans. Anaesthesia for complex adult congenital heart procedures should be undertaken by suitably trained adult congenital anaesthetists.[34]

Transplant patients

This includes patients undergoing heart transplantation, and patients who have previously received a transplant who require further cardiac surgery.

3.6 Consultants or autonomously practicing anaesthetists providing anaesthesia for heart or lung transplantation should have appropriate training and substantial experience of advanced cardiovascular monitoring and support.

3.7 Cardiac anaesthetists working in non-transplant centres should be familiar with the principles of the anaesthetic management of patients who have previously undergone heart or lung transplantation.[43]

3.8 Patients undergoing heart or lung transplantation may be under the age of 18 years. Anaesthetists must be aware of legislation and good practice guidance relevant to young and vulnerable adults.[36,42] Children undergoing transplantation should be cared for in a paediatric centre.

3.9 Facilities should be available for the storage, administration and routine monitoring of immunosuppressive medication.

Pregnant patients

Patients requiring cardiac surgery during pregnancy will typically be undergoing an urgent or emergency intervention. Indications include chest trauma, acute coronary ischaemia, aortic or coronary dissection, decompensated valvular disease and acute cardiomyopathy.

3.10 Cardiac anaesthetists should be familiar with the normal physiological effects of pregnancy and the general principles of obstetric anaesthesia.[44]

3.11 Where cardiac surgery is scheduled to occur immediately after Caesarean section, there should be early involvement of obstetricians, specialist obstetric anaesthetists, neonatal paediatricians and midwifery services.

3.12 Equipment, services and facilities should be equivalent to those found in an obstetric unit.[45]

3.13 Whenever possible, escalation in care should ideally not lead to the separation of mother and baby.

3.14 A multidisciplinary team should agree and document plans for the peripartum management of patients with known congenital or acquired cardiac disease in advance. Staff and facilities should be available for monitored or operative delivery, and for managing acute decompensation.

Chronic thromboembolic pulmonary hypertension patients

3.15 A subgroup of patients with chronic thromboembolic pulmonary hypertension (CTEPH) will benefit from surgery and should be managed in designated national centres. Currently only one UK centre provides specialist surgical intervention for patients with CTEPH.

Extracorporeal membrane oxygenation

3.16 The use of ECMO for adult patients with severe respiratory failure is commissioned by the NHS in a small number of specialist centres who are able to undertake patient retrieva. The use of ECMO for adult patients with cardiovascular collapse is currently commissioned by the NHS mainly in cardiothoracic transplant centres as a bridge to transplant. An increasing number of non-transplant cardiothoracic and heart attack centres are providing non-commissioned ECMO and other ECLS services.ECMO should only be provided by staff who are trained and are working within approved clinical governance arrangements.

Cardiac catheter laboratories

Anaesthetists are requested to provide services for an increasing number of structural, electrophysiological and interventional cardiology procedures such as TAVI, including emergency procedures. The same conditions and requirements apply as for the radiology department outlined in chapter 7,[46] with some additional conditions:

3.17 Anaesthetists should be aware of the risks of exposure to ionizing radiation in cardiac catheterisation laboratories and ensure they use protective garments and screens and wear exposure monitoring devices if requested to do so.[47]

3.18 The use of dedicated anaesthetic monitoring equipment, in addition to any monitoring used by cardiologists, is recommended. A remote or slave anaesthetic monitor display should be available to cardiologists.

3.19 Cardiac patients are often at high risk of cardiac arrest. Sufficient space and facilities should be available for managing this eventuality. Transoesophageal echocardiography should be immediately available.

3.20 Cardiovascular instability may, on occasion, necessitate the use of extracorporeal support including cardiopulmonary bypass. Catheter laboratories should have sufficient space, medical gas outlets, electrical sockets, network sockets, and other essential facilities to meet this demand.

3.21 Where revision of rhythm management devices is considered to pose a high risk of requiring emergency surgical intervention, cardiopulmonary bypass equipment and a plan for surgery should be available at the start of the procedure. [48]

Preassessment

3.22 In recent years there has been a trend towards assessment of elective patients in preadmission clinics, typically one to two weeks before surgery. This allows routine paperwork and investigations to be completed before admission, permits 'same day' admission and reduces the likelihood of delays or cancellation.[49] Anaesthetists should be part of the preadmission clinical pathway, including implementing interventions to promote enhanced recovery and preselection of patients suitable for enhanced recovery, this activity should be reflected in job plans. [9,50,51,52]

4 Training and education

4.1 Cardiac anaesthesia is a 'key unit of training' for stage 2 training in anaesthesia[43] Trainee anaesthetists should be of appropriate seniority to be able to benefit from this area of training.

4.2 All anaesthetists in training should be appropriately clinically supervised at all times.[53]

4.3 Trainees should have an appropriate balance between cardiac and ICU training based on their individual requirements.

4.4 Trainees planning to embark in a career in cardiac anaesthesia should be encouraged to undertake training and accreditation in transoesophageal echocardiography.[30]

4.5 Consultant or autonomously practicing anaesthetists intending to undertake anaesthesia for cardiac surgery should have received training to a higher level in cardiac anaesthesia, for a minimum of one year in recognised training centres, as part of general training. [43] Those providing critical care for cardiothoracic surgical patients should have received training as described by the Faculty of Intensive Care Medicine (see Cardiothoracic Critical Care, Guidelines for the Provision of Intensive Care Services (GPICS)).[6] This must include full training in transoesophageal echocardiography.

4.6 Consultant or autonomously practicing anaesthetists intending to follow a career in paediatric cardiothoracic anaesthesia should have higher training in general paediatric anaesthesia of at least one year followed by a specialist training period of an appropriate duration in the subspeciality.

4.7 All staff should have access to adequate time, funding and facilities to undertake and update training that is relevant to their clinical practice, including annual mandatory training such as basic life support.

4.8 Fellowship posts should be identified to allow additional training for those who wish to follow a career in cardiac anaesthesia(Including ACHD and paediatric cardiac anaesthesia) to help ensure there are adequate numbers of skilled anaesthetists in the specialty. These should be suitable for trainees who wish to take time out of training programmes, or for those who are post certificate of completion of training (CCT). Such posts should provide similar or enhanced levels of teaching, training and access to study leave as for regular training posts.

4.9 Departments should consider providing all newly appointed consultants or autonomously practicing anaesthetists, particularly those with limited experience, with a mentor to facilitate their development in cardiac anaesthesia.

5 Organisation and administration

5.1 Anaesthetic involvement in the leadership of cardiac units should be considered.

5.2 There should be a joint forum for discussion of matters relevant to both surgeons and anaesthetists, for example protocol development and critical incidents.

5.3 Clinical protocols should be developed from national and international guidelines and reviewed and implemented on a regular basis. This may include, for example, guidance for coagulation management, VTE treatment and for anaemia and patient blood management[70].

5.4 Anaesthetists should be part of the multidisciplinary team engaged in development and implementation of enhanced recovery programmes in cardiac surgery. [51,52]

5.5 Hospitals should have systems in place to facilitate multidisciplinary meetings for discussion of high risk and complex cardiac cases to allow for adequate advance planning of service provision.

5.6 All handovers should contain representatives for the multidisciplinary teams from both theatre and the receiving area and should be documented and structured to ensure continuity of care.[54]

5.7 The theatre team should all engage in the use of the World Health Organization (WHO) surgical safety checklist,[55] commencing with a team brief, and concluding the list with a team debrief. The debrief should highlight things done well and 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. Deficiencies highlighted at the end of the team brief should be addressed in a timely and appropriate manner.

5.8 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 (NatSSIPs) or the Scottish Patient Safety Programme in Scotland.[56,57] Organisational leaders are ultimately responsible for implementing local safety standards as necessary.

5.9 There should be sufficient numbers of clinical programmed activities in clinicians' job plans to provide cover for all elective cardiac operating lists and to provide adequate emergency cover.[58] Compensatory rest periods for out of hours on-call work should be appropriately included in rotas and job planning. This may affect the subsequent day's scheduled theatre activity and staffing provisions should be made for this[72].

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 Service developments outside the operating theatre, e.g. interventional cardiology, often place unintended demands on anaesthetists. The business plans for such services should include provision for anaesthetic services.

7 Research, audit and quality improvement

7.1 Most research in cardiac anaesthesia will be undertaken in specialist cardiac units and should be given high priority with appropriate time and infrastructure support.

7.2 Regular clinical audit of the work of cardiac anaesthesia services is essential. This should also include submission of data to national audits, such as the ACTACC national audit project. Information technology (IT) support should be available for such activities.[1,59]

7.3 Centres should consider contributing to multidisciplinary national benchmarking audits such as NICOR, GIRFT and NCBC.[60]

7.4 All cardiac units should have regular multidisciplinary morbidity and mortality meetings. These should have a list of patients to discuss in advance, an attendance register, and minutes with learning points. Consultant or autonomously practicing anaesthetists should attend these meetings and where possible inclusion in job plans should be considered. Trainees should be encouraged to attend during their attachments.

7.5 Robust procedures should be in place to report and investigate adverse incidents involving equipment, staff or patients. The published outcomes of these investigations should be disseminated to all relevant anaesthetists and others.

8 Implementation support

The Anaesthesia Clinical Services Accreditation (ACSA) scheme, run by the RCoA, aims to provide support for departments of anaesthesia to implement the recommendations contained in the GPAS chapters. The scheme provides a set of standards, and asks departments of anaesthesia to benchmark themselves against these using a self-assessment form available on the RCoA website. Every standard in ACSA is based on recommendation(s) contained in GPAS. The ACSA standards are reviewed annually and republished approximately four months after GPAS review and republication to ensure that they reflect current GPAS recommendations. ACSA standards include links to the relevant GPAS recommendations so that departments can refer to them while working through their gap analyses.

Departments of anaesthesia can subscribe to the ACSA process on payment of an appropriate fee. Once subscribed, they are provided with a 'College guide' (a member of the RCoA working group that oversees the process), or an experienced reviewer to assist them with identifying actions required to meet the standards. Departments must demonstrate adherence to all 'priority one'

standards listed in the standards document to receive accreditation from the RCoA. This is confirmed during a visit to the department by a group of four ACSA reviewers (two clinical reviewers, a lay reviewer and an administrator), who submit a report back to the ACSA committee.

The ACSA committee has committed to building a 'good practice library', which will be used to collect and share documentation such as policies and checklists, as well as case studies of how departments have overcome barriers to implementation of the standards, or have implemented the standards in innovative ways.

One of the outcomes of the ACSA process is to test the standards (and by doing so to test the GPAS recommendations) to ensure that they can be implemented by departments of anaesthesia and to consider any difficulties that may result from implementation. The ACSA committee has committed to measuring and reporting feedback of this type from departments engaging in the scheme back to the CDGs updating the guidance via the GPAS technical team.

9 Patient information

The Royal College of Anaesthetists have developed a range of Trusted Information Creator Kitemark accredited patient information resources that can be accessed from our website. Our main leaflets are now translated into more than 20 languages, including Welsh.

In order to give valid informed consent, patients need to understand the nature and purpose of the procedure. Full guidance, including on providing information to vulnerable patients, can be found in chapter 2.[9] Specific considerations for cardiac surgery are outlined below:

9.1 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 modifications (https://www.bhf.org.uk/informationsupport/publications/preventing-heart-disease). Sources of information about the anaesthetic should also be available such as those from the Royal College of Anaesthetists.[9,61,62]

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

9.3 Information on specific individual risks of invasive monitoring, e.g. risk of injury due to arterial and central venous lines, blood product transfusion and transoesophageal echocardiography should be available to patients.

9.4 All cardiothoracic units should provide patient information about preoperative smoking cessation, including how to access local services to support patients wishing to quit before their operation.

Areas for future development

There is an increasing use of mechanical circulatory support in cardiac anaesthesia, cardiac critical care and cardiology services within the NHS. As experience and the evidence base of this grows, more marginal indications for mechanical support will emerge. Post-cardiotomy support following transplantation and pulmonary endarterectomy is established, while venoarterial ECMO (VA-ECMO) following cardiac surgery generally has poor outcomes.[63] Where services require percutaneous support, e.g. ECMO in cardiology, business cases should include provision of senior anaesthetic and critical care support. The use of mobile retrieval for ECMO provision is increasingly in use. The use of algorithm and AI based clinical decision support systems in theatre and intensive care to guide therapy will increase.

Risk of stroke increases with patient age and surgical complexity. Access to acute stroke services is, most often, only required following embolic stroke, e.g. for clot retrieval. Patients should have access to the same rehabilitation facilities as other stroke patients.

There is an expansion of minimally invasive and percutaneous procedures, e.g. balloon pulmonary angioplasty in patients with chronic thromboembolic pulmonary hypertension deemed unsuitable for surgery. Evidence of symptomatic and prognostic benefit is awaited.

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.[35]

Abbreviations

ACSA	Anaesthesia Clinical Services Accreditation
ACTACC	Association for Cardiothoracic Anaesthesia and Critical Care
BiPAP	Bilevel positive airway pressure
CDG	Chapter Development Group
CPAP	Continuous positive airway pressure
CQC	Care Quality Commission
CTEPH	Chronic thromboembolic pulmonary hypertension
DOAC	Direct Oral Anticoagulant
ECMO	Extracorporeal membrane oxygenation
GMC	General Medical Council
GPAS	Guidelines for the Provision of Anaesthetic Services
GPICS	Guidelines for the Provision of Intensive Care Services
GPP	Good Practice Point
HFNO	High-flow nasal oxygen therapy
HDU	High dependency unit
NHS	National Health Service
NICE	National Institute for Health and Care Excellence
PSC	Professional Standards Committee
QMSG	Quality Management of Service Group
RATS	Robot-assisted thoracic surgery
RCoA	Royal College of Anaesthetists
RCTs	Randomised controlled trials
SAS	Specialty and associate specialist
TAVI	Transcatheter aortic valve implantation
VATS	Video-assisted thoracic surgery

Glossary

Clinical lead – SAS doctors undertaking lead roles should be autonomously practicing 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 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.

Reference

1 Papachristofi O, Sharples LD, Mackay JH *et al.* The contribution of the anaesthetist to risk-adjusted mortality after cardiac surgery. *Anaesth* 2016;71:138–76

2 The Anaesthesia Team 2018. Association of Anaesthetists. London 2018 (bit.ly/3dMDc6O)

3 Hyder JA, Bohman JK, Kor DJ, *et al.* Anesthesia care transitions and risk of postoperative complications. *Anesth Analg* 2016; 122: 134–44

4 Service specifications for cardiac surgery. *NHSE*, 2015 (bit.ly/1P8Nd7h)

5 Dunning J, Nandi J, Ariffin S, Jerstice J, Danitsch D, Levine A. The Cardiac Surgery Advanced Life Support Course (CALS): delivering significant improvements in emergency cardiothoracic care. *Ann Thorac Surg* 2006; 81: 1767–72

6 Guidelines for the provision of intensive care services. *FICM and ICS,* 2019 (bit.ly/2PPiJgQ)

7 Recommendations for standards of monitoring during cardiopulmonary bypass. *ACTACC, and SCTS*, 2022 (bit.ly/2Z0KuZM)

8 Guide to good practice in clinical perfusion. *DH*, 2009 (bit.ly/1o3zYEi)

9 Guidelines for the Provision of Anaesthesia Services for the Perioperative Care of Elective and Urgent Care Patients. RCoA 2021

10 Recommendations for standards of monitoring during anaesthesia and recovery 2021. *Anaesth* 2021; 76: 1212-1223

11 Aya HD, Cecconi M, Hamilton M, Rhodes A. Goal-directed therapy in cardiac surgery: a systematic review and meta-analysis. *Br J Anaesth* 2013; 110: 510–7

12 Schmid F, Goepfert MS, Kuhnt D *et al*. The wolf is crying in the operating room: patient monitor and anesthesia workstation alarming patterns during cardiac surgery. *Anesth Analg* 2011;112: 78–83

13 Association of Anaesthetists of Great Britain and Ireland. AAGBI guidelines: the use of blood components and their alternatives 2016. *Anaesthesia* 2016; 71: 829-42

14 Guidance on the use of ultrasound locating devices for placing central venous catheters. *NICE*, 2002 (bit.ly/2lOCAR8)

15 Forrest AP, Lovelock ND, Hu JM, Fletcher SN. The impact of intraoperative transoesophageal echocardiography on an unselected cardiac surgical population: a review of 2343 cases. *Anaesth Intensive Care* 2002; 30: 734–41

16 Klein AA Snell A, Nashef SA, Hall RM, Kneeshaw JD, Arrowsmith JE. The impact of intra-operative transoesophageal echocardiography on cardiac surgical practice. *Anaesth* 2009; 64: 947–52

18 Kunst G, Wahba A, Boer C, et al. 2019, EACTS/EACTA/EBCP Guidelines on Cardiopulmonary Bypass in Adult Cardiac Surgery. *Brit J Anaesth*. 2019, 123:713-757

19 Zangrillo A et al. Preoperative intra-aortic balloon pump to reduce mortality in coronary artery bypass graft: a meta-analysis of randomized controlled trials. *Crit Care* 2015;19(1):10

20 Kanagala P et al. Guidelines for transoesophageal echocardiographic probe cleaning and disinfection from the British Society of Echocardiography. *Eur J Echocardiogr* 2011;12(10):17–23

21 Bengur AR et al. Intraoperative transesophageal echocardiography in congenital heart disease. *Semin Thorac Cardiovasc Surg* 1998;10(4):255–64

22 Jijeh AM et al. Role of intraoperative transesophageal echocardiography in pediatric cardiac surgery. *J Saudi Heart Assoc* 2016;28(2):89–94

23 Ramalingam G, Choi S, Agarwal S *et al.* Complications related to peri-operative transoesophageal echocardiography - a one-year prospective national audit by the Association of Cardiothoracic Anaesthesia and Critical Care. *Anaesthesia* 2020; 75: 21-6

24 Baxter R, Squiers J, Conner W et al. Enhanced recovery after surgery - a narrative review of its application in cardiac surgery. *Annals of Thoracic Surgery* 2020; 109 (6) 1937-1944

25 Grant MC, Isada T, Ruzankin P, et al. Results from an enhanced recovery program for cardiac surgery. *Journal of Thoracic & Cardiovascular Surgery* 2020; 159 (4) 1393-1402

26 Fahrendorff M et al. The use of viscoelastic haemostatic assays in goal-directing treatment with allogeneic blood products: a systematic review and meta-analysis. *Scand J Trauma Resusc Emerg Med* 2017;25(1):39

27 Zarbock A, Küllmar M, Ostermann M, Lucchese G, Baig K, Cennamo A, et al Prevention of cardiac surgery-associated AKI by implementing the KDIGO guidelines in high risk patients identified by biomarkers: the PrevAKI-multicenter randomized controlled trial. Anesth Analg. 2021, 133:292-302

28 Checking anaesthetic equipment. *AAGBI*, 2012 (bit.ly/1sRK9Gb)

29 British Society of Echocardiography. *BSE* (bit.ly/1wtFl2o)

30 Association for Cardiothoracic Anaesthesia and Critical Care TOE accreditation guides. *ACTACC*, (bit.ly/2ALfPox)

31 Sharma V, Fletcher SN. A review of echocardiography in anaesthetic and peri-operative practice, part 2: training and accreditation. *Anaesth* 2014;69:919–27

32 Skinner HJ et al. An investigation into the causes of unexpected intra-operative transoesophageal echocardiography findings. *Anaesth* 2012;67:355–60

33 Guidelines for the provision of paediatric anaesthesia services. *RCoA*, 2020

34 Congenital heart disease standards and specifications. *NHSE*, 2016 (bit.ly/2vf8zOn)

35 Quality standards for the care of critically ill children (5th edition). *PICS*, 2015 (bit.ly/2kVJOig)

36 0–18 years: guidance for all doctors. *GMC*, 2007 (http://bit.ly/2oJdALi)

37 The Family Proceedings Courts (Children Act 1989) (Amendment) Rules 2004 (SI 2004 No.3376, L25)

38 Age of Legal Capacity (Scotland) Act 1991. *HMSO* (http://bit.ly/1h9V7uU)

39 Children (Scotland) Act 1995. *HMSO* (bit.ly/1h9Ve9O)

40 Northern Ireland Child Care law – 'the rough guide'. *DHSSPSNI*, 2004

41 Adult congenital heart disease review – engagement. *NHS Specialised Services*, 2016 (bit.ly/2hG9aUG)

42 Safeguarding children and young people: roles and competencies for health care staff (intercollegiate document). *RCPCH*, 2014 (bit.ly/2oc4Obl)

43 2021 Curriculum for a CCT in anaesthetics. *RCoA*, 2021 (bit.ly/3UFNwyh)

44 Fernandes SM, Arendt KW, Landzberg MJ, Economy KE, Khairy P. Pregnant women with congenital heart disease: Cardiac, anesthetic and obstetrical implications. Expert Review of Cardiovascular Therapy 2010; 8 (3) 439-448.

45 Guidelines for the provision of anaesthesia services for an obstetric population. *RCoA*, 2020

46 Guidelines for the provision of anaesthesia services in the non-theatre environment. *RCoA*, 2021

47 Exposure to ionising radiation from medical imaging: safety advice. *PHE,* 2014 (bit.ly/2uXtvWz)

48 Feldman JB, Stone ME Anesthesia teams managing pacemakers and ICDs for the perioperative period: enhanced patient safety and improved workflows. Current Opinion in Anaesthesiology 2020; 33(3): 441-447.

49 R Farasatkish et al. Can preoperative anesthesia consultation clinic help to reduce operating room cancellation rate of cardiac surgery on the day of surgery? *Middle East J Anaesthesiol* 2009;20(1):93–6

50 Arora RC, Brown CH, Sanjanwala RM, McKelvie R. NEW prehabilitation: a 3-way approach to improve postoperative survival and health-related quality of life in cardiac surgery patients. Canadian Journal of Cardiology 2018; 34: 839-49

51 Engelman D, Ben A, William J *et al*. Guidelines for Perioperative Care in Cardiac Surgery: Enhanced Recovery After Surgery Society Recommendations. *JAMA Surgery* 2019; 154: 755-66

52 Gregory A, Grant M, Manning M *et al.* Enhanced Recovery After Cardiac Surgery (ERAS Cardiac) Recommendations: An Important First Step-But There Is Much Work to Be Done. J Cardiothorac *Vasc Anesth* 2020; 34: 39-47

53 Working arrangements for consultant anaesthetists in the United Kingdom. *AAGBI*, 2011 (bit.ly/2meMUE5)

54 Denomme J, Isac M, Syed S, Yu J, Centofanti J. Transitions in critical care - evaluating the implementation of a handover tool for postoperative cardiac surgery patients. *Canadian Journal of Anesthesia* 2019; 66 S117-18

55 World Alliance for Patient Safety – implementation manual surgical safety checklist: safes surgery saves lives. *WHO*, 2008 (bit.ly/1cQ6tkS)

56 National safety standards for invasive procedures (NatSSIPs). *NHSE*, 2015 (bit.ly/1K6fRY2)

57 Scottish Patient Safety Programme (bit.ly/2lkzPTb)

58 Working arrangements for consultant anaesthetists in the United Kingdom. *AAGBI*, 2011 (bit.ly/2vf6FgN)

59 Klein AA et al. The incidence and importance of anaemia in patients undergoing cardiac surgery in the UK – the first Association of Cardiothoracic Anaesthetists national audit. *Anaesth* 2016;71(6):627–35

60 The National Cardiac Benchmarking Collaborative (bit.ly/3y2TRdd)

61 Joint briefing: smoking and surgery. *Action on Smoking and Health*, 2016 (bit.ly/2vfl3p9)

62 Your anaesthetic for heart surgery. Information for patients and carers. RCoA, 2020 (bit.ly/3bOWvsv)

63 Schmidt M et al. Predicting survival after ECMO for refractory cardiogenic shock: the survival after veno-arterial-ECMO (SAVE)-score. Eur Heart J 2015;36(33):2246–56