Guidelines for the Provision of Paediatric Anaesthesia Services

Consultation Draft Nov 2021

Declarations of Interest

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

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

Medicolegal implications of GPAS Guidelines

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

Promoting equality and addressing health inequalities

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

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

GPAS Guidelines in context

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

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

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

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

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

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

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

Aims and objectives

The objective of this chapter is to promote current best practice for service provision in paediatric anaesthesia. This guidance is intended for use by anaesthetists with responsibilities for service delivery and healthcare managers and covers the patient age group of 0 to 19 years.

This Guideline does not comprehensively describe clinical best practice in paediatric anaesthesia, 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 paediatric anaesthesia applies to all departments who treat children and young people.

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 paediatric anaesthesia. In some cases it has been necessary to include recommendations for 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 process.

Scope

Objective

To provide and describe current best practice in the provision of anaesthetic services within paediatric surgery and paediatric interventions for anaesthetists and healthcare managers with responsibilities for service delivery, supported by evidence and national recommendations where available.

Target population

Groups that will be covered:

- All patients less than 19 years of age undergoing elective or emergency anaesthesia.
- All anaesthetic departments providing services for infants, children and young people in the above age groups.
- All anaesthetists caring for neonates, infants, children and young people.

Groups that will not be covered:

- Provision of paediatric services by a specialty other than anaesthesia.

Healthcare setting

All settings within the hospital in which paediatric anaesthetic services are provided.

Clinical management

Key components needed to ensure provision of high quality anaesthetic services for paediatric patients requiring surgery and/or interventions which involve anaesthetists.

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 critical care, resuscitation, interventional and diagnostic radiology, radiotherapy, endoscopy, satellite sites and the emergency department
- training and education
- research and audit
- organisation and administration
- patient information
- time critical transfers and retrievals.

Issues that will not be covered

Clinical guidelines specifying how healthcare professionals should care for patients.
National level issues.

Introduction

Infants, children, and young people have different requirements. There are marked developmental changes within the paediatric age range, and neonates, infants, and prepubertal children under the age of 8–12 years have particular anatomical and physiological differences. Doses of drugs and fluids need to be precisely calculated, and anaesthetic equipment for smaller children differs from that used in older children and adults.

After puberty, anatomical and physiological characteristics approach those of adults. At all ages, children and young people have distinct emotional and social requirements.

Children and young people aged under 19 years may require anaesthesia to allow treatment for a variety of surgical conditions, much of which will be elective and relatively straightforward and which, in healthy infants and children, can usually be performed in non-specialist paediatric tertiary centres.

Infants and children may also require anaesthesia or sedation for non-surgical procedures involving radiology, cardiac catheterisation, endoscopy, joint injection, chemotherapy radiotherapy and proton beam therapy.

Children with significant acute or chronic medical problems, those undergoing complex procedures (including cardiothoracic and neurosurgery), neonates and small infants, are usually referred to specialist tertiary paediatric centres.

Non-specialist tertiary paediatric centres (see Glossary) are those where both adults and children receive treatment. In a non-specialist paediatric tertiary centre most of the service users are adults. Children's services may be provided in specific wards or in specific areas within the emergency department or in theatres. Not all non-specialist paediatric tertiary centres have inpatient paediatric surgical wards or access to out of hours paediatric services. Therefore, there are important differences between the recommendations for the provision of paediatric anaesthesia in non-specialist paediatric tertiary centres and those for specialist tertiary paediatric centres (see Glossary). Where recommendations are specific to the type of hospital these are indicated in the recommendation.

Both planned and urgent/emergency anaesthesia and surgery for children should be commissioned within the context of a network of care, with pathways of care agreed by specialist and non-specialist providers within the operating delivery network.

A multicentre observational study of severe critical events occurring during paediatric anaesthesia in 261 European hospitals, was published in 2017.[1] Sub-group analysis of the UK cohort indicated that the overall incidence of severe critical events was lower in UK patients when compared to the whole and that sicker patients tended to be cared for by more experienced teams. Whilst this may be reassuring, the study authors have identified several areas for quality improvement that are relevant to the provision of paediatric anaesthesia in the UK.[2]

Resuscitation services are included in this guidance, as anaesthetists play a crucial role in these services in most hospitals at present. Sedation services that are not provided by an anaesthetist are not included.

All relevant GPAS chapters include a section on the treatment of children and young people that will overlap with this document.

Recommendations

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

1 Staffing Requirements

1.1 Anaesthetists who care for children should have received appropriate training and must ensure that at annual appraisals competence in anaesthesia and resuscitation is deemed adequate for the cases undertaken by that individual.[3,4]

1.2 An appropriately trained and experienced anaesthetist should be present throughout the conduct of anaesthesia for all procedures, including those procedures requiring intravenous sedation (where provision of this service has been agreed by the anaesthetic department). In exceptional circumstances, for example, where urgent treatment for another patient requires the anaesthetist to leave the patient, they should delegate responsibility to another appropriate person, in line with GMC guidance on delegation.[5,6]

1.3 Within hospitals there should be multidisciplinary agreement on the level of anaesthetic staffing requirements and competence for the local provision of surgical services based on the clinical need, surgical and anaesthetic experience and training, children's ward facilities and paediatric medical provision. Organisations should liaise with regional ODNs to develop in partnership a framework for local hospitals to follow.

1.4 All patients requiring anaesthesia, pain management, or perioperative medical or intensive care should have a named and documented supervisory autonomously practising anaesthetist (see Glossary) who has overall responsibility for the care of the patient. To ensure

the safety of patients, anaesthetists in training, SAS doctors who are not autonomously practising and anaesthesia associates should be subject to an appropriate level of supervision of all their clinical practice.[7]

1.5 There should be a locally agreed policy on the level of consultant supervision required, based on the age, complexity and co-morbidities of the patient.[3,8,9]

1.6 In the period immediately after anaesthesia, the child should be managed in a recovery area, staffed on a one-to-one basis at least until the child can manage their own airway. The staff in this area should have paediatric experience and current paediatric competencies, including resuscitation. [10,11] An extra member of staff in the recovery area can be extremely useful in the event of an emergency arising.

1.7 An additional member of staff with advanced training in life support for children should always be available to assist where required.[12,13,14]

1.8 All paediatric patients undergoing anaesthesia should have immediate access to a consultant paediatrician.[15]

1.9 When a child undergoes anaesthesia or an anaesthetic department provides sedation services, there should be a dedicated trained assistant, i.e. an operating department practitioner (ODP) or equivalent, who has had paediatric experience and maintained their paediatric competencies.[11]

1.10 In non-specialist paediatric tertiary centres (see Glossary), when a child undergoes anaesthesia or an anaesthetic department provides sedation services, departments should consider allocating two ODPs to a list that includes infants. This facilitates paediatric experience and maintenance of competencies within the anaesthesia team.

2 Equipment, services and facilities

Equipment

A range of monitoring devices and paediatric anaesthetic equipment should be readily available in all areas where children are anaesthetised and in recovery areas.[6]

2.1 Equipment should be available and maintained that is appropriate for use in neonates, infants and children of all sizes and ages, including:

- equipment for airway management and monitoring airway patency, including video laryngoscopy and capnography in an easily accessible location.[16] A standardised paediatric difficult airway trolley should be located in areas of the hospital where paediatric airway management is required including the operating theatres, emergency department and critical care units[17]
- paediatric breathing systems
- invasive haemodynamic monitoring
- pulse oximetry sensors and blood pressure cuffs
- vascular access equipment, including intraosseous needles
- devices to allow rapid and accurate fluid and drug delivery
- equipment for warming fluids
- patient warming devices
- equipment for measuring patient temperature

- total intravenous anaesthesia (TIVA) pumps with paediatric algorithms
- ultrasound devices with a dedicated paediatric probe (for central venous and nerve identification)[18,19]
- equipment on the ward for recording weight and height.

2.2 Equipment for near patient testing of glucose, haemoglobin, blood gases and electrolytes should be readily available. In situations where major blood loss is anticipated, access to thromboelastography, blood cell salvage techniques and haematology laboratory should be considered.[20]

2.3 Intravenous fluid management should conform to NICE guidelines, and appropriate equipment to deliver this safely and accurately should be available.[20]

2.4 Resuscitation drugs and equipment, including an appropriate defibrillator, cuffed tracheal tubes of various sizes and a cuff pressure gauge should be readily available wherever children are anaesthetised.[13,21,22,23]

2.5 There should be ventilators available that have the flexibility to be used over a wide size and age range, and that provide accurate pressure control and positive end-expiratory pressure.

2.6 Theatre temperature should be capable of regulation to at least 23°C, and up to 28°C where neonatal surgery is performed. There should be accurate thermostatic controls that permit rapid change in temperature.

Support services

2.7 Children undergoing anaesthesia should be offered a preadmission assessment service either face to face, via telephone or through computer based virtual platforms prior to the day of their procedure.

2.8 Children undergoing anaesthesia and their families should be offered input from play specialists to help prepare the child for anaesthesia.[24]

2.9 Referral pathways should be available to a paediatric psychology service.[25]

2.10 Blood transfusion and diagnostic services should meet the requirements of neonates, infants, and children. A massive transfusion protocol, including provision for children, should be in place.

2.11 There should be pharmacy staff available with clinical knowledge appropriate to the local paediatric case mix to provide advice on the management of drugs in children.

2.12 There should be awareness that the paediatric population is at greater risk of drug errors. Local systems and training in human factors should be in place to minimise and report prescription and drug administration errors.[26,27]

2.13 There should be local systems in place to disseminate national safety alerts.

2.14 There should be access to the 'British National Formulary for Children' online and in all areas where children are managed.[28]

2.15 There should be a fully resourced children's inpatient pain service.[29,30] The service should be delivered by an appropriately trained and experienced multidisciplinary team (MDT), with specific skills in children's pain management. The team may include clinical nurse specialists, anaesthetists, paediatricians, surgeons, pharmacists, child psychologists and physiotherapists. In hospitals with a smaller paediatric caseload, and non-complex surgical procedures

children's inpatient pain management may be provided by the adult inpatient pain service liaising with the paediatric anaesthetic team. Detailed recommendations for pain management can be found in Chapter 11: Guidelines for the Provision of Anaesthesia Services for Inpatient Pain Management.

2.16 There should be a named paediatric pain management lead. This may be from the anaesthetic team or from an allied specialty.

2.17 Analgesia guidance appropriate for children should be readily available. This should include training in and the use of pain assessment using age-appropriate validated tools, prescribing of analgesics and where appropriate guidelines on the use of complex analgesic techniques such as Nurse and Patient Controlled Analgesia, peripheral nerve local anaesthetic catheters.[30,31] Regional ODNs can provide a useful resource for this information.

2.18 All specialist tertiary paediatric centres should have access to paediatric chronic pain services to assist in managing complex cases. Other centres should develop a network to provide access to paediatric chronic pain services for advice and guidance.

Facilities

2.19 Children should be separated from, and not managed directly alongside adults throughout the patient pathway, including reception and recovery areas. Where complete physical separation is not possible, the use of screens or curtains, whilst not ideal, may provide a solution.

2.20 The appearance of the anaesthetic induction and recovery areas should consider the emotional and physical needs of children.

2.21 Parents and carers should be allowed timely access to the recovery area or, if this is not feasible, children should be reunited with their parents or carers as soon as possible.

2.22 Services and facilities should take account of the specific needs of adolescents where these are different from those of children and adults.[32,33,34,35]

2.23 Arrangements should be in place to enable at least one parent or carer to stay with children who require overnight admission to hospital.

3 Areas of Special Requirement

The recommendations for the provision of anaesthetic services to children for anaesthetic specialised practice, e.g. neuroanaesthesia, for burns and plastics surgery, for cardiac and thoracic surgery, are detailed in the 'Areas of Special Requirement' of the relevant chapters of GPAS.

Neonates (0 to 28 Days[36])

Neonates presenting for anaesthesia and surgery are at high risk. They frequently have complex multisystem congenital problems requiring specialist critical care perioperatively. Anaesthesia in this age group requires knowledge of the particular pathophysiology of these conditions and the impact of anaesthesia on neonatal physiology.

It should be recognised that babies with congenital problems, and in particular babies who were born prematurely, i.e. before the 37th week of pregnancy, may continue to pose a high risk when undergoing anaesthesia.[37]

3.1 Where separation from the parents occurs, arrangements should be in place to allow communication and visits by the parents as soon as possible.

3.2 The MDT involved in neonatal anaesthetic care should have appropriate experience with this age group. In most areas this will require centralisation in specialist tertiary paediatric centres (see Glossary) for both emergency and elective procedures.

3.3 The theatre should have the capacity to reach a temperature of 28°C.

3.4 Warming devices for the patient and fluid warming should be available.

3.5 Equipment suitable for this age group, e.g. pulse oximeter sensors of an appropriate size, should be available and checked.

Children with learning and/ or communication difficulties

3.6 Consideration should be given to appropriate strategies for recognising and managing anxiety of children particularly at induction e.g. play specialists, counselling, psychological support and anaesthetic training around managing preoperative anxiety.[3]

3.7 Staff should take into consideration the needs of patients who have a hospital passport. A copy of the hospital passport should be kept in the patients notes and should be referred to throughout the perioperative pathway.

3.8 Children with learning disabilities should ideally be recovered in an area with lower levels of noise and lighting and a familiar presence, such as a parent or their carer.

3.9 The presence of learning disability practitioners in recovery when a patient with learning disability is being recovered should be considered.

3.10 Consideration should be given to reunite patients with learning and/ or communication difficulties with their parents and/ or carers as soon as possible following a procedure.

3.11 Staff should liaise with a trust lead for patients with learning difficulties.[38]

Paediatric trauma

Networks are now nationally agreed for trauma management in children. Anaesthetists have a key role in these teams. The recommendations on the provision of anaesthetic services for paediatric trauma can be found in the Chapter 16: Guidelines for the Provision of Anaesthesia Services for Trauma and Orthopaedic Surgery.

The increased centralisation of elective surgical services for young children has reduced the proportion of staff who are confident in the emergency management of critically ill or injured children. Children and young people present at a range of hospital settings, or may deteriorate anywhere in the hospital. All staff find these situations stressful, and therefore plans and simulated MDT training for paediatric resuscitation anywhere in the hospital provide valuable learning opportunities.

3.12 Where children present with major trauma to a non-trauma centre, the guidelines for emergency resuscitation, stabilisation and transfer detailed below should apply.

The critically ill child

The general provision of services for the critically ill child within a critical care setting is not within the scope of this chapter. Further information can be found in the Paediatric Critical Care Society's 'Quality Standards for the care of critically ill children' 2021.[13]

Sick children may require short-term admission to a general critical care facility, e.g. while awaiting the arrival of the paediatric intensive care unit (PICU) retrieval team, or when only a very short period of critical care that does not necessitate transfer to a PICU is required. This is acceptable,

provided there is a suitable facility within the hospital, there are staff with the appropriate competencies and the episode will last only a few hours.

3.13 Hospitals admitting children should be part of a fully funded critical care network.

3.14 Paediatric early warning scores should be used to help identify the deteriorating or critically ill child.

3.15 There should be local hospital protocols in place that are clear on the roles and responsibilities of the MDT in caring for the critically ill child.[37] Individual hospitals will have different personnel providing anaesthetic support to these teams.

3.16 Hospitals should have clear operational policies regarding the care of young people aged 16-18 years of age and for all babies who have been discharged from neonatal units.[13]

3.17 Individuals with responsibilities for paediatric resuscitation and stabilisation should fulfil the training requirements and maintain their competencies.[21]

3.18 Staff without recent paediatric experience or training may be able to contribute transferable skills as part of the MDT, e.g. expertise with ultrasound to assist with line placement or echocardiography skills, and such contribution should be supported by local protocols.

3.19 In all emergency departments receiving infants and children, neonatal and paediatric resuscitation equipment (including airway equipment), medications (including anaesthetic drugs) and fluids should be available to prepare an infant or child for PICU transfer.[39]

3.20 There should be immediate access to protocols for management of acute life-threatening conditions. These will often be agreed with the local PICU network or PIC transport team. Protocols should include acute respiratory, cardiovascular or neurological emergencies, trauma, poisoning and major burns.[13]

3.21 Hospitals without a suitable PICU/NICU bed should obtain the advice of the local PICU transport team as soon as possible during the management of the sick or critically injured child or young person.

3.22 Specialist tertiary paediatric centres with PICU facilities should provide clinical advice and help in locating a suitable PICU bed once a referral has been made.

3.23 There should be data collection for all referrals to PICU.

3.24 There should be a nominated lead consultant and nurse within general critical care units, who are responsible for the policies and procedures for babies and children when they are admitted.[13]

3.25 In the event of unusual circumstances, e.g. pandemic flu, adult critical care units should have a contingency plan for longer periods of paediatric critical care delivery.

3.26 Neonates, infants and children who are likely to require critical care following an operation should undergo their surgery in a hospital/unit with a designated PICU or NICU.[40,41]

3.27 If the patient is too sick to transfer to such a hospital prior to surgery and their current hospital has surgeons capable of operating, then transfer should occur as soon after surgery as is clinically appropriate.[13]

3.28 Non-specialist paediatric tertiary centres should have arrangements for managing and treating simple surgical emergencies in children such as acute appendicitis; in addition, they

should be able to resuscitate and stabilise critically ill infants and children of all ages prior to transfer to a specialist centre for surgery and/or critical care.

3.29 In non-specialist paediatric tertiary centres that provide level 3 care for adults, children should receive level 3 care in these areas for a short period with advice from children's critical units in specialist tertiary paediatric centres or from regional transport teams.

Transfer of critically ill children

The transfer of critically ill children to specialist tertiary paediatric centres is generally undertaken by paediatric critical care transport teams.[41,42] In some circumstances, it may be necessary for the referring hospital to provide an emergency transfer of a sick child who is intubated and ventilated. This may occur particularly in the case of a child who presents at a non-specialist paediatric tertiary centre and requires a time critical transfer e.g. for an acute neurosurgical emergency or major trauma[41]. In these circumstances, the child will need to be accompanied by an appropriate senior anaesthetist.[43] The usual transport team should provide advice, even where urgent transfer is undertaken by the local referring hospital.

3.30 There should be a designated consultant with responsibility for transfers who provides and updates a written policy for emergency transfers of critically ill children.

3.31 There should be portable age appropriate monitors, transfer equipment (including a portable ventilator) and drugs readily available to transfer critically ill children.

3.32 There should be relevant written local guidelines, with telephone numbers of the receiving unit.

3.33 Patients being transferred should normally be accompanied by a doctor or another healthcare professional e.g. advanced nurse practitioner or anaesthetic practitioner with relevant competencies in the care of a critically ill child and transfer of intubated patients, including airway management skills. They should be accompanied by a suitably trained assistant.

3.34 Transport services should ensure that appropriate multidisciplinary arrangements are in place to review transfers and provide feedback to networked hospitals.

Day care procedures and anaesthesia

Day surgery is particularly appropriate for children provided the operation is not complex or prolonged, and the child is well, with either no comorbidity, or well controlled comorbidity. Even children with relatively complex needs, e.g. those with cerebral palsy or cystic fibrosis, can be managed as day cases, provided they are stable with minimal cardiorespiratory problems, and the proposed surgery is unlikely to preclude same day discharge.[44]

3.35 Infants, children and young people should have their day surgery delivered to the same standards as inpatient care, but with additional consideration of measures to promote early discharge. In particular, younger infants should be scheduled early in the day to allow sufficient time for recovery and discharge on the same day.

3.36 Infants, children and young people should be managed in a dedicated paediatric unit, or have specific time allocated in a mixed adult/paediatric unit, where they are separated from adult patients.

3.37 The lower age limit for day surgery will depend on the facilities and experience of staff and the medical condition of the infant. Significantly ex-preterm infants should generally not be considered for day surgery unless they are medically fit and have reached a corrected age of 60 weeks. Risks should be discussed with parents and carers on an individual basis.

3.38 Parents, carers, children and young people should be provided with good quality preoperative information, including information on fasting and on what to do if the child becomes unwell before the operation. Postoperative analgesia requirements should be anticipated, and discussed at the preadmission assessment visit.

3.39 Specific guidance for the prevention and treatment of postoperative nausea and vomiting in children and young people should be available.[45]

3.40 There should be clear documented discharge criteria following day case surgery.

3.41 Discharge advice should be detailed and carefully worded to facilitate ongoing care by parents or carers.

3.42 A local policy on analgesia for home use should be in place, with either provision of medications, or advice to parents and carers before admission to purchase suitable simple analgesics. In both instances, there should be clear instructions to parents and carers about their regular use in the correct dose and for a suitable duration. Parents and carers should be given written instructions on administration of analgesia and know who to contact if problems arise. In addition, safe practice with medicines when children are present should be emphasised.

Teenagers and young adults

Teenagers and young people have particular physical and psychosocial needs.

3.43 The decision on the most appropriate place for the treatment of a teenager or young person should be made on an individual basis, balancing the expertise of the clinician in the patient's condition against any effort to fully separate adult patients from teenagers. Local operating policies should be in place to support this decision.

3.44 Where treatment is carried out in facilities normally used by adult patients, such as obstetric units or for patients requiring ECT treatment, guidelines should be in place for staff training and organisation of services.[46,47]

Transitional care

3.45 Where children are transferring from paediatric to adult services there should be the opportunity to advise them about possible changes in anaesthesia management. Examples may include the use of sedation for some procedures that previously would have been managed with general anaesthesia, or the use of alternatives to topical anaesthesia.[35]

3.46 A person centred approach should be used to ensure that the young person is an equal partner in decisions regarding their care during this transitional period.[35]

3.47 Anaesthesia records from their previous care should be available to the new service (or a summary document should be provided).[35]

3.48 Health and social care service managers in children's and adults' services should work together in an integrated way to ensure a smooth and gradual transition for young people. Anaesthetic input should be considered for the transition of complex young people.[48]

4 Training and education

Anaesthesia for children should be undertaken or supervised by anaesthetists who have undergone appropriate training. In the UK, all anaesthetists receiving a Certificate of Completion of Training (CCT) will have undertaken paediatric anaesthesia training; the competencies obtained vary slightly depending on the iteration of the curriculum followed. Further information regarding the

curriculum is available from the RCoA website.[3] As a minimum upon CCT they should be competent to provide safe perioperative care for common non-complex elective and emergency procedures in children aged one year and older. Anaesthetists providing care to a wider and more complex paediatric population will have acquired more advanced competencies.

Unless there is no requirement to anaesthetise children, either for elective or emergency procedures, it is expected that the competence and confidence to treat children will be maintained. This may be via direct care, continuing professional development (CPD) activities, refresher courses, visits to other centres or by doubling up and working with more experienced colleagues from the same or other centres. This should be objectively reviewed regularly and assured through annual appraisal and revalidation.

4.1 Anaesthetists with a substantial commitment to paediatric anaesthesia should have satisfied the higher and advanced level competency based training requirements in paediatric anaesthesia on the 2010 RCoA curriculum or completed the final stage of training (stage 3) and specialist interest area on the 2021 RCoA curriculum or equivalent.[3] It is recognised that anaesthetists involved in highly specialised areas such as paediatric cardiac and neurosurgery will require additional training that is individually tailored to their needs.[49]

4.2 All anaesthetists who provide elective or emergency care for infants, children or young adults should have training in advanced life support that covers their expected range of clinical practice and responsibilities.[50,51] These competencies should be maintained by annual training that are ideally multidisciplinary and scenario based.[52]

4.3 Anaesthetists should be aware of legislation and good practice guidance relevant to children and according to the location in the UK. [53,54,55,56,57] These documents refer to the rights of the child, child protection processes, and consent.

4.4 All anaesthetists must undertake at least level 2 training in safeguarding/child protection, and must maintain this level of competence by annual updates of current policy and practice and case discussion.[58,59] Safeguarding resources to support learning can be found on the RCoA website (www.rcoa.ac.uk/safeguardingplus).

4.5 At least one consultant in each department should take the lead in safeguarding/child protection and undertake training and maintain core level 3 competencies.[60] The lead anaesthetist for safeguarding/child protection should advise on and co-ordinate training within their department but will not have responsibility for deciding on management of individual clinical cases.

4.6 Anaesthetists who do not have regular children's lists but who do have both daytime and out of hours responsibility for providing care for children requiring emergency surgery should maintain appropriate clinical knowledge and skills.

4.7 The establishment of regional ODNs for children's surgery and anaesthesia will provide education that is over and above the core requirements of trusts. ODN education will add value, drive consistency and a high-quality service through shared learning.

4.8 There should be funding and arrangements for study leave such that all consultants and SOS doctors who have any responsibility to provide anaesthesia for children are able to participate in relevant CPD that relates to paediatric anaesthesia and resuscitation and to their level of specialty practice. Individual CPD requirements should be jointly agreed during the appraisal process.

4.9 There should be evidence of appropriate and relevant paediatric CPD in the five-year revalidation cycle.[61]

4.10 Anaesthetists returning to paediatric practice after a period of absence should have a structured plan of induction and supervision in place which supports their learning needs so that they are competent to provide safe perioperative care for common non-complex elective and emergency procedures in children aged one year and older.[62]

4.11 In non-specialist paediatric tertiary centres, consultant anaesthetists who care for children should have the opportunity to undertake regular supernumerary attachments to operating lists or secondments to specialist tertiary paediatric centres.

4.12 In non-specialist paediatric tertiary centres, having visiting consultant paediatric anaesthetists from specialist tertiary paediatric centres to attend operating lists to provide education and training updates should be considered. These may be part of the arrangements in place within a children's surgery ODN. The Certificate of Fitness for Honorary Practice may facilitate such placements and provides a relatively simple system for updates in specialist centres.[63] Paediatric simulation work may also be useful in helping to maintain paediatric knowledge and skills.

5 Organisation and administration

5.1 Hospitals should define the extent of elective and emergency surgical provision for children, and the thresholds for transfer to other centres as part of an ODN for children's surgery.

5.2 Non-specialist tertiary paediatric centres should have a multidisciplinary committee for paediatric care to formulate and review provision. This committee should involve anaesthetists, paediatricians, surgeons, emergency department representatives, senior children's nurses, managers and other professionals, such as paediatric pharmacists. In some hospitals, this will also include critical care physicians.

5.3 In non-specialist tertiary paediatric centres a multidisciplinary committee should be responsible for the overall management, governance and quality improvement of anaesthetic and surgical services for children, and should report directly to the hospital board.[9]

5.4 The opinions of children, young people and their families should be sought in the design and evaluation of services and future planning.[64]

5.5 All hospitals that provide surgery for children and young people should have clear operational policies regarding who can anaesthetise children for elective and emergency surgery. This will be based on ongoing clinical experience, the age of the child, the complexity of surgery and the presence of any comorbidities.[8,15]

5.6 In all centres admitting children, one or more anaesthetist should be appointed as clinical lead (see Glossary) for paediatric anaesthesia. Typically, they should undertake at least one paediatric list each week and will be responsible for co-ordinating and overseeing anaesthetic services for children, with particular reference to teaching and training, audit, equipment, guidelines, pain management and resuscitation. There should be a trust wide policy on paediatric sedation services.[65]

5.7 Children and young people undergoing surgery should be placed on designated children's operating lists in a separate children's theatre area. When this is not possible, children and young people should be given priority by placing them at the beginning of a mixed list of elective or emergency cases.

5.8 A WHO checklist should be completed before and during all procedures and investigations under anaesthesia and sedation, if provided by the anaesthetic department. A pre-

procedure team safety brief should be undertaken as per the national safety standards for invasive procedures.[66]

5.9 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 and Wales, the Scottish Patient Safety Programme in Scotland and Safety and quality standards in Northern Ireland.[67,68,69] Organisational leaders are ultimately responsible for implementing local safety standards as necessary.

5.10 A family centred approach to the perioperative care pathway should be adopted, with physical separation between adult patients and children in the operating department, recovery area, day units and in the emergency department whenever possible.[15,70]

5.11 All children and young people should be assessed before their operation by an anaesthetist. Parents and carers, as well as the child, should be given the opportunity to ask questions and to be involved in the physical and psychological preparation for surgery.

5.12 Parents and carers should be involved throughout the care process. With the agreement of the anaesthetist in charge of the case on the day, they should be able to accompany children to the anaesthetic room, remain present for induction of anaesthesia and be able to gain easy access to the recovery area. In special circumstances, such as with some small babies and with anticipated difficult intubations, this may not be possible.

Regional networks

Paediatric services should be co-ordinated through regional ODNs which include children's surgery and anaesthesia. These should be established and maintained by commissioning groups.[71] The ODNs provide collaborative multidisciplinary working between children's clinical service providers within a defined geographical region focused on a specialist tertiary paediatric centre.

5.13 Hospitals should engage with networks to develop agreed standard patient care pathways based on age, comorbidity and complexity of procedure, as well as clinical urgency. There should be multidirectional flow of patients within the care pathways as part of the ODN determined by patient needs to local service provision, staffing and geography.

5.14 The ODN and the hospitals within the network should work in partnership in providing a framework for CPD education and training, audit and standards for clinical care to meet the needs of individual clinicians within the network and the local service provision.

5.15 Sharing of resources amongst hospitals within the network should be encouraged and facilitated.

5.16 Surgical and anaesthetic ODNs should work with existing paediatric critically ill networks to ensure links between departments of paediatrics, surgery, anaesthesia and critical care in non-specialist paediatric tertiary centres and the corresponding specialist tertiary paediatric centres.

5.17 Hospitals that are specialist paediatric tertiary centres should have on site access to a paediatric critical care transport service commissioned for the retrieval or transfer of critically ill or injured infants, children and young people.[13]

5.18 Units without inpatient paediatric beds should have a formal arrangement with a neighbouring unit, to ensure that practical assistance is available should a child require transfer.[9] Protocols should be in place for the rapid assessment and transfer of patients to the local specialist unit within the network.[13]

Access to critical care facilities

Critical care facilities for children are not available in all hospitals where children are anaesthetised. Paediatric high dependency and critical care facilities should be available and delivered within a network of care that supports major/complex surgery, and critically ill or injured infants and children.

5.19 Onsite Children's Critical Care and HDU services should be appropriate to the type of surgery performed and the age and comorbidity of patients and should be available to support the delivery of more complex postoperative analgesic techniques.

5.20 In hospitals with no onsite paediatric high dependency and critical care facilities, there should be the facilities and expertise to initiate critical care prior to transfer/retrieval to a designated regional PICU/HDU facility. This may involve short-term use of adult/general ICU facilities and clear pathways of communication and referral.[13]

Guidelines

5.21 There should be ready access to evidence based guidelines that are appropriate for children on the following topics:

- management of pain, nausea and vomiting
- fluid fasting[72]
- intravenous fluid management[20]
- prevention of perioperative venous thromboembolism[73]
- death of the child in theatre
- protocols for anaesthetic emergencies, including:
  - anaphylaxis[74]
  - malignant hyperthermia
  - difficult airway management
  - airway obstruction
  - resuscitation
  - local anaesthetic toxicity
  - major haemorrhage
  - emergency paediatric tracheostomy management.[75]

5.22 When infants and children undergo procedures under sedation alone, recommended published guidance for the conduct of paediatric sedation should be used for example guidance published by NICE and the Academy of Medical Royal Colleges.[76,77,78]

5.23 Guidance on pre-procedure pregnancy testing in female patients should be followed.[79]

6 Financial Considerations

Part of the methodology used for making recommendations in the chapter 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; rather 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 their financial impact when

widely accepted into future practice. It is impossible to make an overall assessment of this financial impact with the currently available information.

7 Research, audit and quality improvement

The use of improvement science methodology plays an important role in the quality assurance process and in measuring performance.

7.1 Quality indicators, such as unplanned inpatient admission following day case surgery, readmission within 28 days, or unanticipated admission to PICU following surgery, should be measured, collated and analysed, and can be compared within regional networks. A number of suggested audit topics specifically relating to paediatric anaesthesia are set out in the RCoA document 'Raising the standard: a compendium of audit recipes'.[80]

7.2 Regional ODNs could provide agreed quality standards for the perioperative care of infants, children and young people, and units could be encouraged to participate in regular collation of data relating to these standards. Participation in national audit should also be encouraged.[5]

7.3 Quality improvement projects in relevant areas of paediatric anaesthetic practice should be agreed and implemented.[1,75]

7.4 Adoption of national initiatives, for example 'Hello my name is' should be encouraged and evaluated.[81]

7.5 Multidisciplinary audit and morbidity and mortality meetings relating to paediatric anaesthesia and procedures, including resuscitation, should be held regularly. Perioperative death in infants and children is rare. When a death occurs within 30 days of surgery, a multidisciplinary meeting should be convened and a note made in the clinical record.[15] In the event of any unexpected child death, whether related to surgery or not, this must be reported to the local Child Death Overview Panel. This will usually be the responsibility of the local designated paediatrician, and the process for notification of a child death must be followed.[82]

7.6 Audit activity should include the regular analysis and multidisciplinary review of untoward incidents. Serious events and near misses need to be thoroughly investigated and reported to the relevant national agency, in line with national requirements. Learning from serious events and near misses should be fed back to the MDT.[83]

7.7 There should be ongoing audit of all children transferred between hospitals for surgery. ODNs and local hospitals should work in partnership to monitor this.

7.8 Anaesthetic research in children should be facilitated when possible and should follow strict ethical standards.[84]

7.9 Anaesthetists who care for children and young people should be familiar with relevant patient safety issues.[85]

8 Implementation Support

Anaesthesia Clinical Services Accreditation scheme

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.

Peer review

Peer Review is a free service which aims to support departments, help develop their services, and share and disseminate aspects of good practice between departments across the country.

Peer review started in 1999 between major UK Children's hospitals and was soon extended to include paediatric anaesthesia departments in University and District General hospitals. It works alongside ACSA, but is more focussed on determining what might work best for the particular department with the facilities that are available to it, rather than looking to achieve specific standards.

A team of peer reviewers consists of three or four consultant anaesthetists (from a mix of specialist tertiary paediatric centres and district general hospitals) and a lay reviewer. Unlike the ACSA report, which is sent to the College, the peer review report is sent to the department for their own safekeeping. Information from a peer review is recognised by ACSA provided a full ACSA review is undertaken within four years of the peer review. It can therefore be a stepping stone with constructive feedback towards a full ACSA review.

9 Patient Information

All parents or legal guardians of children and young people undergoing anaesthesia should be as well informed as possible about the planned procedure, including methods for induction of anaesthesia and analgesia. Information should be given about the associated risks and side effects, and families should be encouraged to ask questions and be involved in decisions about their child's care. Children and young people should receive information appropriate to their age and understanding. Young people should be encouraged to participate in decisions about their own care where appropriate.

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.

9.1 Families should be provided with written or web-based resources that provide information specific to anaesthesia before the planned surgery/procedure, and contact details for the preassessment team should be provided in case they have further questions or need to speak directly with their anaesthetist.[86] The leaflet 'Information for teenagers, children and parents' is available from the RCoA website, and other leaflets there and on the Association of Paediatric Anaesthetists of Great Britain and Ireland (APAGBI) website provide other patient, parent and carer information resources.[86,87,88,89]

9.2 Information provided preoperatively should include:

- anaesthetic technique; analgesia plan, including regional blockade; any additional procedures, e.g. invasive monitoring, blood transfusion; and planned postoperative care in a critical care environment
- a statement that the ultimate decision making will take place on the day of surgery, according to the needs and safety of the child and as judged by the attending anaesthetist; and that planned resources, e.g. critical care beds, could be unexpectedly unavailable on the day and this may also be part of the decision making
- a description of generally common side effects, e.g. sore throat and postoperative nausea and vomiting, and significant risks, e.g. allergic reactions; also, any additional risks particular to the individual child and their comorbidities
- concerns raised in discussion with a child or young person or parents and carers, e.g. fear of needles, fear of facemasks, loss of control (which is common in teenagers), emergence delirium, awareness, postoperative pain, postoperative nausea and vomiting, and the risk to the developing brain of anaesthesia in young children[90,91]
- preoperative fasting instruction should be given verbally and in writing; the timing should be appropriate to the proposed theatre list start time[92]
- information on the use of unlicensed medicines and/or licensed medicines for off label indication if requested.[93]

9.3 Young children have an increased incidence of postoperative delirium. Recovery staff should have an increased awareness for the management of this condition.

9.4 Information provided postoperatively should include the safe use of analgesia after surgery and discharge from hospital, and what to do and who to contact in the event of a problem or concern. This should include telephone numbers where advice may be sought 24 hours a day.

9.5 Information should be clear and consistent. It should be given verbally and also in written and/or electronic form.[94]

9.6 Children should receive information before admission that is appropriate to their age and level of understanding. Information can be provided at face-to-face meetings by nurses and play therapists, and enhanced with booklets, web links, online apps or videos.[95]

9.7 Young people have additional needs and may wish to speak to the anaesthetist or another member of staff without direct parental presence.[64,96] Anaesthetists should make it clear that they are willing to speak with young people on their own, on request.

9.8 Post menarcheal female patients should be made aware of the need for clinicians to establish pregnancy status before surgery or procedures involving anaesthesia. While obtaining and documenting this information is primarily the responsibility of the operating surgeon or paediatrician, anaesthetists may also feel it necessary to confirm that such checks have been performed. Trusts should have agreed policies and arrangements for information, consent and disclosure of results.[79]

Consent

All children should be included in discussions regarding their health and treatment as much as possible given their level of comprehension. When a child is not able to consent for themselves (see below), consent should be sought from someone with parental responsibility, but the child can also be invited to signify their assent on the consent form if they wish to do so.[53,97]

Young people of 16 and 17 years can independently give consent unless they can be shown not to have capacity. Where they do not have capacity, someone with parental responsibility or a group of professionals involved in the child's care who can agree that the treatment is in best interest of the child can give consent (except in Scotland where the same rules as for adults apply).[55,56]

Children under the age of 16 who have sufficient intelligence and maturity to fully understand treatments that are proposed are referred to as being 'Gillick competent' and can give consent themselves.[98]

9.9 Anaesthetists treating children and young people must ensure that they understand the requirements for consent in the part of the UK in which they are working.[53,55,56,57]

9.10 Parental responsibility should be established in advance of admission, and appropriate consent procedures followed, involving the court and/or social services as appropriate.

9.11 For planned procedures, if there is doubt about parental responsibility, advice should be sought from senior hospital medicolegal advisors and/or defence organisations.

9.12 Although separate written consent for anaesthesia is not mandatory in the UK, there should be a written record of all discussions with the child and/or parent/carers about methods of induction, and provision of postoperative pain relief (including the use of suppositories).[99,100]

9.13 Where special techniques such as neuraxial blockade and regional blocks, invasive monitoring and blood transfusions are anticipated, there should normally be written evidence that this has been discussed with the child or young person and/or their parents or carers as appropriate.[99,100]

9.14 Children may require anaesthesia for diagnostic procedures, such as MRI scans.

The consent process is essentially composed of two components: consent for the procedure and consent for the general anaesthesia or sedation.

The referring clinician (or radiologist in some institutions) is responsible for the explanation of risks vs benefits, including the possible risks if the imaging is not carried out. This should occur early in the process, prior to the day of the procedure, and it should be made clear that there are associated significant risks of general anaesthesia which are rare and state a general order of risk. The discussion needs to be recorded and written consent obtained from parents or legal guardian. This is regardless of where the referring clinician is based, often in another institution.

The consent for general anaesthesia or sedation must include a more detailed discussion of side effects and likely risks regarding the individual child. The conversation must be

documented but written consent for anaesthesia is not (currently) mandatory in the UK but may be subject to local governance policies in some trusts.

Consent for the procedure should be reconfirmed on the day.[101]

9.15 If withdrawing or withholding life-sustaining treatments is being considered, possible outcomes and plans should be carefully discussed and documented by the multidisciplinary team of professionals and the family/young person (as appropriate), in advance of planned anaesthesia and including the management of 'do not attempt cardiopulmonary resuscitation' orders.[102,103,104]

9.16 Duty of Candour guidelines must be followed.[105]

Areas for future development

The following areas are suggested for further research:

- preadmission assessment services for children
- quality improvement in paediatric services.
- newer monitoring techniques, such as processed EEG monitors used during TIVA
- role of operational delivery networks.

Abbreviations

CDG	Chapter Development Group
GPAS	Guidelines for the Provision of Anaesthetic Services
NICE	National Institute for Health and Care Excellence
ODN	Operational Delivery Network
PICU	Paediatric Intensive Care Unit
RCoA	Royal College of Anaesthetists
SAS	staff grade, associate specialist and specialty

Glossary

Autonomously practising anaesthetists – a consultant or SAS doctor who can function autonomously to a level of defined competencies, as agreed within local clinical governance frameworks.

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.

Non-specialist paediatric tertiary centres - are hospitals who care for children providing non-specialist children's surgery, do not have onsite children's critical care facilities and also do not have a dedicated paediatric anaesthesia on call rota. Examples of the type of children's surgery include ENT surgery such as adenotonsillectomy, paediatric general surgery such as inguinal hernia repair. Non-specialist paediatric tertiary centres may have visiting children's specialist surgeons such a paediatric general surgeon who provides surgical procedures for children if these are not available locally. This would include the majority of district general hospitals.

Specialist tertiary paediatric centres - are hospitals that provide tertiary specialist children's surgery including neonatal surgery. These hospitals usually have onsite neonatal and/ or children's critical care facilities with a dedicated paediatric anaesthesia on call rota. Specialist tertiary paediatric centres may be standalone children's hospitals or be part of university teaching hospitals with separate facilities for children. Examples of the type of children's surgery include congenital neonatal and general paediatric surgery, paediatric neurosurgery, and paediatric cardiac surgery.

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