Guidance on the provision of Paediatric Anaesthetic Services

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

Summary

- Anaesthesia services for children require specially trained clinical staff together with equipment, facilities and an environment appropriate to the needs of children.[1]
- The service should be led at all times by consultants who regularly anaesthetise children.[2,3]
- At all times, there must be adequate trained assistance;[4] skilled assistance for paediatric anaesthesia should be provided by staff specifically trained for the task.
- In a life-threatening emergency where transfer is not feasible, the most senior appropriately experienced anaesthetist available should undertake anaesthesia.[5]
- Paediatric resuscitation equipment must be available wherever and whenever children are treated and staff must receive regular retraining in paediatric life support.[1]
- There should be a properly staffed[1] and funded acute pain service that covers the needs of children.
- Paediatric High Dependency and Intensive Care services should be available as appropriate for the type of surgery performed.[6,7]
- Parents (or carers) should, wherever possible, be involved in all aspects of care and decisions regarding the management of their children.[8–11]

Introduction: The importance of Paediatric anaesthesia services

- Children comprise 25% of the population. Many will require anaesthesia to allow treatment for a variety of surgical conditions involving Ear, Nose and Throat (ENT), orthopaedic, dental, plastic, cardiothoracic, ophthalmic and paediatric surgery.
- Children who undergo anaesthesia and surgery have special requirements. They are not small adults; they differ physiologically, emotionally and socially. 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.
- Wherever and whenever children undergo anaesthesia and surgery, their particular needs must be recognised and they should be managed in separate facilities and looked after by staff with appropriate experience and training.
- Most surgical procedures performed on children will be elective, relatively straightforward and performed in district general hospitals, usually on fit infants and children.
- Children with significant acute or chronic medical problems, those undergoing more complex procedures, neonates and small infants are usually referred to specialist units or tertiary paediatric centres.[12–15]

- Nevertheless, district general hospitals should have arrangements for managing and treating simple surgical emergencies; in addition they should be able to resuscitate and stabilise seriously ill children of all ages, prior to their transfer.
- At all times anaesthesia in children should be undertaken or supervised by consultants who have undergone appropriate training in paediatric anaesthesia (see section 4: Training and Education).
- All consultant anaesthetists with a Certificate of Completion of Specialist Training (CCST) will have obtained basic paediatric anaesthetic training (or equivalent) as SpRs, following which they should, as a minimum, have been competent to provide anaesthesia for straightforward elective and emergency surgery for children of American Society of Anesthesiologists (ASA) categories 1 and 2 who have reached their fifth birthday; unless there is no requirement to anaesthetise children it is expected that this competence will need to be sustained through regular exposure, Continuing Education and Professional Development (CEPD) and/or refresher courses. However, there will be consultants who have acquired more advanced competences thus allowing provision of a more extensive anaesthetic service; these competences will still require to be sustained through the same mechanisms.

Levels of provision of service

1 Staffing requirements

1.1 Children should be anaesthetised by consultants who have regular and relevant paediatric practice sufficient to maintain core competencies. Children may also be anaesthetised by Staff or Associate Specialist (SAS) anaesthetists, provided they fulfil the same criteria and there is a nominated supervising consultant anaesthetist. When trainees anaesthetise children, they should be supervised by a consultant with appropriate experience.

1.2 The level of supervision of a trainee will vary according to their ability and experience, the complexity and location of the procedure, the presence of any relevant co-morbidity and the age of the patient. For example, while Senior House Officers (SHOs) with limited experience require direct supervision, experienced SpRs who have undergone a period of paediatric anaesthetic higher training might be supervised by a consultant outside the hospital. If clinical supervision of a trainee is being provided by a SAS anaesthetist, the trainee must always have unimpeded access to a consultant.[16]

1.3 When a child undergoes anaesthesia, the anaesthetist must be assisted by staff (operating department practitioners/assistants/anaesthetic nurses) who have specific paediatric skills and training.

1.4 In the period immediately following anaesthesia, the child should be managed in the recovery ward or post-anaesthesia care unit on a one-to-one basis, by designated staff who undergo regular paediatric resuscitation training. A registered children's nurse should be directly involved with the organisation and training of staff in this area and a member of staff trained and competent in advanced paediatric life support should always be on shift

1.5 Children should be nursed on a ward where there are at least two registered children's nurses on duty for every shift that the child is present.

2 Equipment, support services and facilities

Equipment

2.1 A full range of monitoring devices, paediatric anaesthetic equipment and disposable items for general and regional anaesthesia should be available in theatres and all other areas where children are anaesthetised.[17] This should Include a full range of disposable equipment including the following which should be appropriate for use in children of all sizes and ages:

- blood pressure cuffs;
- intravenous cannulae;
- temperature probes;
- pulse oximetry.

2.2 Resuscitation drugs and equipment, including an appropriate defibrillator, should be routinely available at all sites where children are to be anaesthetised.

2.3 Anaesthetic machines should incorporate ventilators, which have controls and bellows permitting their use over the entire age range together with the facility to provide pressure controlled ventilation.

2.4 There should be appropriate thermostatic control of the operating room; temperature monitoring and patient warming devices should be available in both the operating room and recovery area.

2.5 Intravenous fluids should normally be administered only by volumetric infusion pumps.

Support services

2.6 Paediatric High Dependency and Intensive Care services should be available as appropriate for the type of surgery performed.[6,7]

2.7 Children undergoing anaesthesia and surgery as day cases or in-patients will benefit from the input of play-specialists who can help in the preparation of the child for surgery.[1]

2.8 On-site haematology, chemical pathology and blood transfusion services should meet the requirements of infants and children with particular reference to the removal and analysis of small blood samples. The use of routine pre-operative blood testing should be kept to a minimum, unless there are specific clinical indications.

2.9 There should be pharmacy staff with specialised paediatric knowledge available to provide advice and ensure safe and effective management of drugs in children.[1] Where appropriate, intravenous injections and infusions for children should be prepared in the pharmacy under controlled conditions. Copies of a recognised paediatric pharmacopoeia should be widely available and used in all ward and theatre areas.[18]

2.10 There should be a properly staffed and funded acute pain service (APS) which covers the needs of children and undergoes regular audit.* Analgesia guidelines appropriate for children should be readily available and pain scoring should be performed routinely on any child who has undergone a surgical procedure. A member of the acute pain service should attend paediatric wards daily, and all children who have had major surgery should be assessed regularly.

2.11 Particular care is required when infants and children undergo investigations or surgical procedures under sedation alone. Recommended guidelines for the conduct of paediatric sedation have been published by The Scottish Intercollegiate Guidelines Network.[19]

**see Chapter 5: Guidelines for the provision of anaesthetic services for acute pain management.*

Facilities

2.12 Children should be separated from and not managed directly alongside adults, whether this be in the operating theatre department, the post-anaesthesia care unit (recovery), a critical care unit, in-patient wards or the day care unit.[8,20] Theatre design, the appearance of the anaesthetic and recovery areas and working practices should all reflect the emotional and physical needs of children.[1] If there are genuine problems imposed such as by the need to use older buildings or the need of children to be cared for close to a facility that is essential for any aspect of their care, efforts should be made to comply with the overall need for separation from adult patients.

2.13 Recovery areas for children should be separate or screened from those used by adults and provided with paediatric airway and resuscitation equipment.

2.14 In the Accident and Emergency department there should be a separate area for children together with all the necessary resuscitation equipment and protocols, required for managing the seriously ill child.[1]

2.15 Resident accommodation should be available for parents of children who require overnight admission to hospital.

3 Areas of special requirement

Intensive Care: care of the critically ill child

3.1 Children may require admission to critical care facilities, as a planned part of their care, for example after surgery, because of trauma or an acute illness or because of extreme prematurity or illness at birth. Paediatric intensive care is provided in designated units, staffed by doctors and nurses with specialised training.[7,21] Most paediatric intensive care units (PICUs) are based at children's hospitals or tertiary paediatric centres and serve a defined geographical area; they must comply with national standards.[7,22] Children who require intensive care following an operation should therefore undergo their surgery in one of these hospitals/units with a designated PICU.

3.2 However, arrangements for the immediate care of critically ill children should be in place in any hospital which manages children. It must be recognised that this need can arise suddenly and unpredictably in the accident and emergency department, the operating theatre or the in-patient wards. In-house arrangements are therefore required for providing emergency treatment, initiating intensive care and stabilising critically ill children, prior to their transfer to a PICU.[5]

3.3 In all Accident and Emergency departments receiving children, neonatal and paediatric resuscitation equipment should be readily available together with all the necessary equipment, drugs and infusions necessary to resuscitate, stabilise and prepare an infant or child for PICU transfer. Resuscitation equipment should also be available in all other sites where children undergo treatment.[1]

3.4 There should be hospital protocols for management of critically ill children. These include the management of head injuries, the indications for CT scanning, management of acute upper airway obstruction, suspected meningococcal septicaemia, seizures, severe asthma, poisoning and major 'burns'. Clinical management of these children, in tertiary or

non-tertiary settings, will require close co-operation by and multidisciplinary teamwork between nurses, paediatricians, surgeons, anaesthetists, intensivists, and other relevant clinicians. Both during and following the initial stages of resuscitation of a critically ill or 'collapsed' child, it is important that further stabilisation and management is not left within the sole remit of the anaesthetist.

3.5 A critically ill child may require short-term admission to an adult critical care facility while awaiting arrival of the PICU retrieval team. There may also be occasions when a child requires a very short period of intensive care; these may not require transfer to a PICU, provided there is a suitable facility within the hospital and the episode will last only a few hours.

3.6 Transfer of critically ill children to specialist care services is normally undertaken by a paediatric emergency transfer team operating from the appropriate PICU.[22] When this is not feasible (e.g. because the transfer is urgent and the transfer team is not immediately available) the general hospital making the referral may have to undertake the transfer of a critically ill child who is 'intubated and ventilated'. This may occur, particularly, in the case of the child who presents at a district hospital, with a serious head injury and an expanding intracranial haematoma requiring urgent surgical decompression by a neurosurgeon.

Under these circumstances:

- there should be a designated consultant with responsibility for transfers;
- functioning portable monitors, transfer equipment, drugs and relevant guidelines must be available;
- patients should be accompanied by a doctor, normally with two years post-registration experience and relevant experience in paediatric life support. Both should be accompanied by a suitably trained assistant.

3.7 Portable transfer monitors and equipment with appropriate staff will also be required when transferring a critically ill child between different departments of a hospital (e.g. Accident and Emergency department to CT scan or ICU).

Day care surgery and anaesthesia

3.8 Day care surgery is particularly appropriate for children, provided the operation is not complex or prolonged and the child is healthy with no significant co-existing medical illness.

3.9 The management and care of day cases should comply with standards contained in the report 'Just for the Day',[20] irrespective of whether children are managed in a specialist paediatric unit or an adult unit adapted for children.

3.10 Selection for day care surgery should be made according to surgical, anaesthetic, medical and social criteria.

3.11 The lower age limit for day case surgery depends on the facilities and experience of staff and the medical condition of the infant. Preterm or ex-preterm neonates should not be considered for day case surgery unless they are medically fit and healthy and have reached 60 weeks post-conceptual age. Infants with a history of chronic lung disease or 'apnoeas' should be managed in a centre equipped with facilities for post-operative ventilation.[9,10]

3.12 Parents and children should be provided with good quality information which includes fasting guidelines and what to do if the child becomes unwell before or after the operation. There should be clear discharge criteria following day care surgery; they must include drugs for pain relief and clear instructions for their use.

4 Training and Education

4.1 Children who undergo anaesthesia must be managed by staff who have received appropriate training and whose competency in anaesthesia and resuscitation is adequate for the management of the children they serve.

4.2 Consultants with a substantial commitment to paediatric anaesthesia, including full-time paediatric anaesthetists, are usually appointed to posts in specialist children's hospitals or tertiary paediatric units. They will normally have satisfactorily completed 12 months advanced paediatric anaesthesia training in a tertiary centre during years 3–5 of the SpR training programme.[23]

4.3 Some consultants are appointed to posts with a designated sub-specialty interest in paediatric anaesthesia at district general hospitals. In many instances, they are nominated as the lead consultant for paediatric anaesthesia. Typically, they might undertake at least one paediatric list or equivalent per week and are responsible for co-ordinating and overseeing anaesthetic services for children, with particular reference to equipment, protocols, guidelines, pain management, resuscitation services, sedation, teaching etc. These individuals would normally be expected to require at least six months or equivalent of full-time dedicated paediatric

anaesthesia training in a specialist paediatric unit during SpR years 3–5 to gain the necessary competencies.[23] They should also have advanced training in life support for children and have maintained the skills so learnt.

4.4 In paediatrics, as in all areas of anaesthetic practice anaesthetists must recognise and work within the limits of their professional competence. Some anaesthetists working in district general hospitals do not have a regular paediatric commitment; they may, in the absence of a separate paediatric rota, have to provide out-of-hours cover for emergency surgery in children. Anaesthetic involvement may also be required in the management of critically ill children who, on presentation, require intubation, resuscitation and initiation of intensive care before the arrival of a retrieval team and eventual transfer to a PICU. Whilst virtually all career grade anaesthetists, as trainees, will have received some formal training in paediatric anaesthesia, several years may have elapsed since this was obtained. It is important that such consultants obtain training in paediatric resuscitation and are able to maintain these skills. In addition there should be arrangements for undertaking regular supernumerary attachments to paediatric lists (see below), or secondments to specialist centres/paediatric simulator work, in order to update and maintain paediatric knowledge and skills.

4.5 There must be arrangements which are fully funded to enable all consultant and career grade staff who provide anaesthesia or anaesthetic cover for children to participate in CME which relates to paediatric anaesthesia and resuscitation. In particular, consultants who have no fixed paediatric lists but have to provide out-of-hours cover should be encouraged to undertake regular annual CME which involves supervised work with a paediatric anaesthetic colleague.

4.6 Arrangements should also be made between specialist paediatric units and district general hospitals to facilitate CME/Continuing Education and Professional Development (CEPD) and refresher training in paediatric anaesthesia. The establishment of regional groups/networks of paediatric anaesthetists may facilitate joint CME.

4.7 Where appropriate, joint appointments may be considered, allowing designated consultants from district general hospitals a regular commitment within a dedicated tertiary paediatric centre in order to maintain and develop their skills.

5 Research and Audit

5.1 Audit plays a vital role in the quality assurance process and in measuring performance. Simple indicators such as unplanned inpatient admission following day case surgery or unplanned admission to the intensive care unit following surgery can easily be measured and the reasons documented. The information can be analysed and compared with accepted norms. A number of suggested topics, specifically relating to paediatric anaesthesia or adaptable from those suggested for adult anaesthesia, are set out in the Royal College of Anaesthetists document 'Raising the Standard: a compendium of audit recipes'.[24]

5.2 There should be departmental audit and morbidity meetings relating to paediatric anaesthesia. Where appropriate, this should be multidisciplinary and incorporate input from parents, guardians and patients.

5.3 Audit activity should include the regular analysis of critical and report untoward incidents. Serious events and near misses will need to be investigated thoroughly and reported to the National Patient Safety Agency in line with national requirements.

5.4 There should be an audit of all children transferred between hospitals and this should be monitored by the hospital paediatric or other appropriate committee.

6 Organisation and Administration

6.1 There should be a hospital committee consisting of a paediatrician, anaesthetist, surgeon, pharmacist and registered children's nurse. Local protocols should define surgery possible in that particular hospital with regard to such matters as the age and condition of patients, extent of elective and emergency surgical provision, staffing, local environmental constraints and thresholds for transfer to a larger or tertiary unit. This committee should be responsible for the overall management, improvement, integration and audit of anaesthetic and surgical services for children.

6.2 When children are admitted for surgery, their overall care should be supervised by a specialist paediatric surgeon or paediatrician. Where this is not the case, a named paediatric medical consultant should oversee care in conjunction with the child's surgeon.[8]

6.3 Children who undergo surgery should normally be concentrated on designated paediatric operating lists, ideally in a separate children's theatre area.

6.4 In hospitals where children undergo anaesthesia, there should be evidence-based guidelines and protocols relating to resuscitation, peri-operative care and the management of conditions such as anaphylaxis and malignant hyperpyrexia.

6.5 All patients should be assessed before their operations by an anaesthetist; both the parents and the child should be given the opportunity to ask questions.

6.6 There should be systems to ensure the safe use and prescription of drugs in children. There should be awareness of the implications of using'off-label' and 'unlicensed' drugs for children. Copies of approved paediatric formularies (e.g. Medicines for Children) should be available.[18]

6.7 Parents (and others in *loco parentis*) should be involved in the care process. This includes physical and psychological preparation of the patient for surgery. A child centred approach to anaesthesia and surgery should be employed, with as far as possible:

- segregation between adults and children in the operating department, post-anaesthesia care unit, day care unit, in-patient wards and the accident and emergency department
- provision for parents to accompany children, both to the anaesthetic room and into recovery areas.[1] There may be exceptions to this; for example, anticipated difficulty in tracheal intubaton or rapid sequence induction.

6.8 Arrangements should be in place with a specialist paediatric unit for the transfer of sick infants or children.

6.9 It is recommended that regional networks are developed, with the establishment of close links between departments of anaesthesia and critical care in district general hospitals and the corresponding departments in tertiary paediatric centres.[9] This should facilitate provision of advice (when required), the production of evidence based protocols and guidelines and the arrangement of clinical attachments.

7 Patient Information/Consent

7.1 Before the admission of a child for elective surgery, parents should receive full written information together with a contact telephone number should they have further questions. Written information should be based on or make reference to that provided in 'Anaesthesia Explained' and the information leaflets relating to paediatric anaesthesia that are available from the Royal College of Anaesthetists.[25]

7.2 Anaesthetists should be aware of legislation including the 1989 Children Act, rights of the child, child protection issues and the process of obtaining consent.[26]

7.3 Although separate written consent for anaesthesia is not mandatory, there should be discussions with the child and/or parent about methods of induction and provision of post-operative pain relief including the use of suppositories. Where special techniques such as epidural blockade, invasive monitoring and blood transfusions are anticipated there should normally be written evidence that these have been discussed with the child (when appropriate) and with parents.

7.4 In infants and younger children, consent for medical and surgical treatment is obtained from the parent or the legal guardian; minors age 16 and over can consent to medical treatment. Nevertheless, there are be some children under the age of 16 who have sufficient maturity and understanding to decide whether to undergo surgery (see 'Patient Information', section 7 of chapter 2: Guidelines for the provision anaesthetic services for pre-operative care).

Click here to link to Audit Recipe Book Section 7: Paediatric Services

References

1 Getting the right start. National Service Framework for Children: Standard for Hospital Services. *DH*, London 2003. (http://www.dh.gov.uk/assetRoot/04/06/72/51/04067251.pdf).

2 Buck N, Devlin HB, Lunn JN. The report of the National Confidential Enquiry into Perioperative Deaths (1987). *NCEPOD*, London 1989 (http://www.ncepod.org.uk/sum89.htm).

3 Extremes of Age. The Report of the National Confidential Enquiry into Perioperative Deaths (1997–98). *NCEPOD*, London 1999 (http://www.ncepod.org.uk/1999.htm).

4 The anaesthesia team. *AAGBI*, London 1998 (http://www.aagbi.org/pdf/30doc.pdf).

5 Hatch D, Rollin A-M. Organisation of Paediatric Anaesthesia. In: Sumner and Hatch (eds) Paediatric Anaesthesia. *Arnold*, London 1999.

6 High Dependency Care for Children: Report of an Expert Advisory Group. *DH* 2001 (http://www.dh.gov.uk/assetRoot/04/03/42/73/04034273.pdf).

7 Paediatric Intensive Care: a Framework for the Future. Report the National Co-ordinating Group on Paediatric Intensive Care to the Chief Executive of the NHS Executive. *DH*, London 1997 (http://www.dh.gov.uk/assetRoot/04/03/43/42/04034342.pdf).

8 Welfare of Children and Young People in Hospital. *DH*, London HMSO, 1991.

9 Setting Standards for Children Undergoing Surgery. *Action for Sick Children* 1994 (http://www.actionforsickchildren.org/propublications.html).

10 Children First: a study of hospital services. *The Audit Commission* London, HMSO, 1993 (http://www.hmso.gov.uk/)

11 Hall PA, et al. Parents in the recovery room: a survey of parental and staff attitudes, *BMJ* 1995;**310**:163–164.

12 Morray JP et al. A comparison of pediatric and adult anesthesia closed malpractice claims. *Anesthesiology* 1993;*878*:461–467.

13 Holzman RS. Morbidity and mortality in paediatric anesthesia. *Pediatric Clinics of North America* 1994;**41**:239–256.

14 Cote CJ et al. Postoperative apnea in former preterm infants after inguinal heniorrhaphy: a combined analysis. *Anesthesiology* 1995;**82**:809–822.

15 Learning from Bristol: The report of the public inquiry into children's heart surgery at the Bristol Royal Infirmary 1984–1995. *The Stationery Office*, July 2001 (http://www.dh.gov.uk/assetRoot/04/05/94/79/04059479.pdf).

16 The CCST in Anaesthesia I: General Principles; A manual for trainees and trainers (2nd Edition, June 2003) p14. *RCoA*, London.(http://www.rcoa.ac.uk).

17 Guidelines on minimal monitoring in anaesthesia, *AAGBI*, London, 3rd edition 2000 (http://www.aagbi.org/pdf/Absolute.pdf)

18 Medicines for Children 2003. *RCPCH*, London, 2003 (http://www.rcpch.ac.uk/publications/)

19 Safe sedation of children undergoing diagnostic and therapeutic procedures. (Revised April 2004) *Scottish Intercollegiate Guidelines Network*. (http://www.sign.ac.uk).

20 Thornes R. Just for the day: Children admitted to hospital for day treatment. Caring for Children in the Health Service, London,1991.

21 Training in Paediatric Intensive Care Medicine Guidance Documents. The complete programme. Intercollegiate Committee on Training in Paediatric Intensive Care Medicine. *RCoA* London, 2001 (http://www.rcoa.ac.uk).

22 PICS Standards for Paediatric Intensive Care. *Paediatric Intensive Care Society*, Sheffield 2001.

23 The CCST in Anaesthesia III: Competency Based Specialist Registrar Training:Training and Assessment. A manual for trainees and trainers (2nd Edition April 2003). *RCoA*, London 2003 (http://www.rcoa.ac.uk/docs/).

24 Raising the Standard: a compendium of audit recipes for continuous quality improvement in anaesthesia. *RCoA*, London 2000 (http://www.rcoa.ac.uk).

25 Lack JA et al. Raising the Standard: Information for patients. Anaesthesia explained p 89–100; You and your anaesthetic p 101–104; Your child's general anaesthetic p 105–108; Your child's anaesthetic for dental treatment p 117–119. *RCoA*, London, 2003. (http://www.rcoa.ac.uk and http://www.youranaesthetic.info).

26 Children Act 1989 (c.41),ISBN 0105441899. *HMSO*, London 1989 (http://www.hmso.gov.uk/acts/acts1989/Ukpga_19890041_en_1.htm)

Further Reading

Good Medical Practice in Paediatrics and Child Health – Duties and Responsibilities of Paediatricians. *RCPCH*, London 2000 (http://www.rcpch.ac.uk/publications/).