

## Pediatric patient selection and provider issues

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Received 14 October 2004; accepted 23 February 2005

### Abstract

In this article some factors that influence the safety of anesthesia care for infants and children are reviewed. In particular elements of training and ongoing experience necessary for the safe provision of pediatric anesthesia care are identified and also the necessary support needed in terms of personnel and facilities. Several guidelines relating to the provision of pediatric anesthesia care are reviewed. Finally, those infants and children who are at increased anesthetic risk are identified. It is essential that the needs of these at risk patients and the capabilities of the provider and facility are matched.

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*Keywords:* Pediatric; Anesthesia; Training; risk; Competency

### 1. Introduction

The purpose of this article is to review some of the elements needed to undertake anesthesia care for infants and children most safely. For anesthesiologists whose practice is primarily ambulatory anesthesia care, pediatric patients may comprise a significant proportion of their practice. While some of the factors increasing pediatric anesthesia risk will not be relevant in ambulatory settings, such as surgeries requiring intensive care post-operatively, many other factors should be considered to minimize pediatric anesthetic risk. These include elements relating to the training or ongoing experience of the practitioners providing pediatric anesthesia care and also requirements for adequate facilities and support staff. Several studies have reported that perioperative morbidity and mortality from anesthesia is higher in infants and children than in adults [1–3]. Infants and children are anatomically and physiologically different from adults and this impacts their anesthetic risk. Several investigators have shown that centers doing higher volumes of complex cases (like cardiac procedures) have lower mortality than centers with limited case loads [4,5]. Despite the finding that larger centers have lower mortality rates than those who do a smaller

number of cases, many hospitals continue to provide pediatric anesthesia for less than 100 cases per year. Of the hospitals in northern California doing a small number of pediatric cases, 75% are within 50 miles of a larger pediatric center [6].

In the past 15 years, several aspects of pediatric anesthesia have been evaluated, including clarification of competency levels in pediatric anesthesia, making more uniform the elements necessary for programs providing training to become pediatric anesthesiology sub-specialists, and developing guidelines for needed equipment, support and personnel for the anesthetic peri-operative environment for infants and children. We propose to review these developments, their current state, and then to list some of the pediatric subpopulations that deserve thoughtful consideration of the match between a facility's environment, provider expertise and the needs of such children and infants before undertaking their anesthetic care.

Infants undergoing anesthesia may have lower morbidity in the hands of trained pediatric anesthesiologists. Keenan et al. found that the incidence of bradycardia in a retrospective study looking at cases from 1983 to 1992 was 1.27% overall in infants undergoing anesthesia in the first year of life. Bradycardia was less than half as likely when a pediatric anesthesiologist was supervising the case [7]. A study from

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Switzerland was designed to examine risk factors for preoperative adverse respiratory events and found that children not anesthetized by a specialist pediatric anesthesiologist had a 1.7 times increased risk for an adverse respiratory event in the peri-operative period. ENT surgery was also found to be a risk factor [8]. However, a recent observational study from France showed that there is a relatively higher rate of adverse peri-operative events in infants as compared to older children, even in a pediatric teaching hospital with a high annual caseload [9].

## 2. History

In 1990, a panel discussion took place at the Society for Pediatric Anesthesia (SPA) meeting. Its topic was how to define a pediatric anesthesiologist. While eminent individual practitioners were easily identified (such as Bob Smith, Jack Downs, Al Conn, David Steward) there were diverse opinions as to what training was ideal. In this same time frame, the late 1980s and into the 1990s, the growth of managed health care plans and the change in financing of health care in the United States (US) resulted in pressure to accomplish as much care as possible for all patients within the “home” facility. Anecdotal evidence revealed instances where anesthesia staff felt pressure to undertake anesthesia care for patients (such as neonates or infants) outside of their comfort range.

## 3. Training

In 1991, as a follow-up to the SPA panel, a large ad-hoc group interested in pediatric anesthesia was formed. The Study Group on Pediatric Anesthesia included 60 members, with representatives from directors of the pediatric anesthesia components of the Accreditation Council for Graduate Medical Education (ACGME)-accredited anesthesiology residency programs, anesthesia chairs from pediatric hospitals, practitioners of pediatric anesthesia in non-pediatric hospitals, officers of the American Academy of Pediatrics (AAP) section on anesthesiology, SPA and the ASA Committee on Pediatric Anesthesia. They issued Clinical Competency Objectives for Training in Pediatric Anesthesiology in 1995 [10]. This statement divided the expectations for pediatric anesthesia practice for those finishing their core anesthesiology residency (CA-3) and those seeking sub-specialist training. Anesthesiologists finishing their core training were expected to be able to resuscitate neonates, infants and children and accomplish safe anesthesia and post-operative care for routine cases in healthy children and to recognize those infants and children whose clinical condition or planned procedure exceeded the capability of the facility (whether for staff, equipment or support reasons). Pediatric anesthesia sub-specialists should undertake a program of at least one additional year in duration to become proficient to admin-

ister anesthetic care to all neonates, infants and children, as well as accomplish their resuscitation, post-operative care and pain management.

The Association of Paediatric Anaesthetists of Great Britain and Ireland in their recommendations regarding training in pediatric anesthesia, published in 2004 [11] recognize three types of Consultant Anaesthetists (Attending Anesthesiologists). These guidelines refer not only to the initial training required for competency in pediatric anesthesia but also to the need for ongoing exposure to pediatric patients and involvement in continuing medical education.

A “Consultant Paediatric Anaesthetist” is involved with the pediatric patient for at least 50% of their work and devotes a substantial amount of their continuing medical education to pediatric anesthesia and related topics. He/she has received at least a year of training at a regional pediatric center in addition to the general pediatric training received as a normal part of residency (typically 3 months or more in total). This would be the equivalent of fellowship training in the US. A “Consultant Anaesthetist with a Special Interest in Paediatric Anaesthesia” will most likely be working in a District General Hospital. He/she will have at least one pediatric list per week (a half day). During training as a senior resident such a Consultant will have had at least 6 months of training at the regional pediatric center in addition to the more general training received earlier in residency. It is recommended that provision is made for such a Consultant to visit the regional or tertiary center for update and refresher experience. A “Consultant Anaesthetist in General Anaesthetic Practice” should be up to date with pediatric resuscitation and stabilization of the pediatric patient prior to transfer for children under the age of 5 years. These consultants should be able to anesthetize a child over the age of 5 years for common surgical procedures.

A survey conducted in the US by the Study Group on Pediatric Anesthesia and the SPA revealed that pediatric anesthesia fellowship programs were highly varied in case composition, number of trainees, duration of training and in the number and caliber of faculty. Uniformity of the elements needed to train good pediatric anesthesiologists was needed. Using the structure for specialty training available from the ACGME, the necessary components for pediatric anesthesia fellowship programs were developed. This process culminated in application to the ACGME for pediatric anesthesia program accreditation. Approved in 1997, it mandates an established curriculum, sufficient case volume and breadth and a faculty of pediatric anesthesiologists. Site reviews are part of the process, which is detailed and rigorous. Currently there are 43 accredited programs in the US. However there is not currently a process by which individual anesthesiologists can gain a subspecialty certification from the American Board of Anesthesiology in pediatric anesthesia, as there is for pain management and for critical care. Training programs are accredited, but individual practitioners are not certified in the subspecialty of pediatric anesthesia.

#### 4. Environment

To address the concern that adverse events occurring during anesthesia for infants or children were attributed to the anesthesiologist but often had elements resulting from deficiencies in the patient care facility, the AAP section on anesthesiology drafted and published Guidelines for the Pediatric Anesthesia Perioperative Environment in 1999 [12] with input from the SPA and the ASA Committee on Pediatric Anesthesia. This document outlines the use of a written policy in each facility categorizing procedures and pediatric patient populations that may be safely anesthetized and it asks facilities, through their anesthesia department chief, to define a minimum number of cases necessary to maintain staff competency. Identification of infants or children at increased anesthetic risk should be used to assess facility capability and the need for anesthesiologists with special clinical privileges. The factors that increase pediatric anesthesia risk outlined included age (with neonates as the highest risk group), procedures requiring postoperative intensive care, and pediatric patients with coexisting medical conditions. Clinical privileges for anesthesiology staff would be divided. In order to have the special clinical privileges to care for pediatric patients, felt to be at increased anesthetic risk, an anesthesiologist needs to have documented, historic, continuous competence in care for such patients and/or to have graduated from an ACGME-accredited pediatric anesthesia fellowship.

The ASA Committee on Pediatric Anesthesia using a taskforce, also published a pamphlet, “Pediatric Anesthesia: Practice Recommendations” in 2002 [13]. Facilities need to have appropriate personnel, equipment, space allocation and a team of competent health care providers that includes an anesthesiologist with appropriate training and experience to provide safe anesthesia for infants and children. The minimum number of cases to maintain competency should be determined by the head of the department of anesthesiology, with medical staff approval. The elements outlined in this pamphlet overlap with the AAP Guidelines, showing agreement between these two specialty organizations.

“Guidelines for the provision of Anaesthetic Services” was published by the Royal College of Anaesthetists, UK in 1999 and is in the process of being updated in 2004. The guidelines are available on the Royal College of Anaesthetists website [14]. In the section “Guidance on Paediatric Anaesthetic Services”, recommendations are made concerning the provision for the needs of children and their families and the level of training recommended for the staff involved in their care. The guidelines state that provision must be made not only for anesthesia but also for intensive care services and/or the transfer of patients requiring more specialized intensive care. Acute pain relief and resuscitation services must also be provided. Throughout the document the comment is made that parents should be encouraged to be involved in the care of their children and the operating room environment should be suitable for the “emotional and physical needs of children”. This includes allowing for the presence of parents at induc-

tion and having separate or screened off areas for children in the recovery room. Pediatric anesthetic equipment should be available.

The British guidelines also specify that operating room nurses and other operating department practitioners should provide adequate assistance and have adequate training and skills, although the training for these personnel is not specified. Pediatric services should be led by a Consultant Anaesthetist (Attending) who anesthetizes children regularly, at least the equivalent of one operating list per week. All children under the age of 5 should be cared for by a Consultant or under the direct supervision of a Consultant. It is recommended that neonates are cared for in specialist centers and that children under the age of 5 are also transferred to specialist centers if there are no specialized local facilities.

Widely publicized cases of adverse outcomes in pediatric anesthesia in the US have accelerated the development of subgroups of pediatric anesthesiologists in many practices to provide access to pediatric anesthesia expertise at any time of the day or night. Some states, such as Florida and California, have developed guidelines to assist those dealing with this problem.

The California Society of Anesthesiologists has created a model policy, approved by their House of Delegates in June 2003 [15]. Elements modeled on the AAP and ASA documents include medical staff determining in writing which pediatric patients and procedures each facility can safely accomplish, determining criteria for pediatric anesthesia care with increased-risk patients requiring anesthesiologists with ACGME-accredited pediatric anesthesia fellowship graduation or continuous demonstrated competency of such care, and determination by the head of the department of anesthesiology of minimum case number for competency. Most recently, the SPA has published a policy statement on “Provision of Pediatric Anesthesia Care” on its website [16].

#### 5. Risk population

We will finish this review with a list of some factors that define pediatric patients whose problems put them at increased anesthetic risk.

1. Age
  - a. prematurely-born infants (up to 46–60 weeks post-conceptual age)
  - b. neonates (0–1 month)
  - c. infants (1–12 months)
  - d. children (e.g. in the UK any child less than 5 years is considered to be at increased risk for anesthesia and should have a provider with suitable experience)
2. Surgeries
  - a. cardiac procedures
  - b. thoracic surgery, including all open thoracotomies
  - c. major abdominal procedures (e.g. Kasai, necrotizing enterocolitis exploration)

- d. solid organ transplantation
  - e. neurosurgery, including craniotomies and meningomyelocele repairs
  - f. plastic reconstructive surgery, such as craniofacial reconstruction or giant nevus excisions.
- Most of these surgeries are not pertinent to ambulatory centers.
- 3. Co-existing conditions
    - a. residual lung disease from prematurity or diaphragmatic hernia
    - b. palliated congenital heart disease
    - c. neuromuscular disease, e.g. Duchenne's
    - d. congenital syndromes, especially those which include airway anomalies such as:
      - i. Goldenhar Syndrome
      - ii. Treacher Collins
      - iii. Pierre-Robin Anomalad
      - iv. VATER Association
      - v. Beckwith–Weideman
      - vi. Epidermolysis bullosa

For those patients with identified syndromes, two good references are Baum and O'Flaherty's text [17] and Butler's article [18]. These are helpful in assessing if a child's needs fall within the capability of your facility.

## 6. Conclusion

Because anesthesiology has been so successful at decreasing overall morbidity and mortality during the last 20 years, many outside our field believe that there are virtually no risks associated with anesthesia care. This makes it even more critical for us as anesthesiologists to identify the fragile and assure that their needs and our capabilities are matched.

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