PEDIATRIC CONSIDERATIONS IN GENERAL ANESTHESIA

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Anesthetic complications occur more frequently in individuals in their first and seventh decades of life. A good understanding of pediatric anesthesiology can help reduce complications associated with anesthesia in infants and children. Successful anesthesia in this patient population is a combined effort of the anesthesiologist, surgeon, parents, and operating room staff.

PREANESTHETIC EVALUATION

Medical History

Information provided by the parents, surgeon, and pediatrician along with the physical examination enables the anesthesiologist to plan for anesthesia with optimal results. Parents should be questioned specifically regarding: recent upper respiratory tract infections, abnormal reactions to drugs, (including anesthetic agents), drugs currently being taken, familial history of major problems associated with anesthesia, and congenital anomalies.

Although controversial, patients with a recent upper respiratory infection or previous history of croup may be predisposed to postintubation subglottic edema or postoperative pulmonary complications. Therefore, many clinicians allow 2 weeks between a respiratory infection and the induction of anesthesia for elective surgery.

Vital Signs

The preanesthetic physical examination should emphasize the upper airway, lungs, and heart. Vital signs should be taken and recorded. A rectal temperature greater than 38°C (100.4°F) usually constitutes a contradiction to surgery. Pulse rates and respiration rates may be much higher in children and corresponding systolic blood pressure readings may be much lower than adults. (Table 1)

Table 1

PEDIATRIC VITAL SIGNS

AGE	PULSE/MIN	RESPIRATION	SYSTOLIC P
Birth-6 months	140-150	40	60-80
6 Months-1 Year	110-140	30-40	80-90
1-3 Years	100-110	25-30	90
3-4 Years	95-100	25	100
5-10 Years	90-95	24	100-110
10-15 Years	80-90	20	110
>15 Years	75-80	10-20	110-120

Laboratory Studies

The laboratory tests required prior to anesthesia consist of hemoglobin and hematocrit determination, white cell count, and urinalysis (Table 2). Neonatal hemoglobin levels drop progressively until about 6 months of age when adult hemoglobin is produced. Hemoglobin values significantly below 10 g/100 ml should be investigated for the cause of anemia, i.e., poor nutrition, infection, leukemia and lymphoma, neoplasm (Wilm's tumor), hidden hemorrhage (Meckel's diverticulum), chronic nephritis and other chronic metabolic disorders.

Table 2

PEDIATRIC BLOOD COUNT

AGE	HGB (Gms%)	HCT (%)	WBC (mm3)
2 Weeks	13-20	42-66	5-12,000
3 Months	9.5-14.5	31-41	6-18,000
6 Months to 6 Years	10.5-14.0	33-42	6-15,000
7 Years to 12 Years	1.0-16.0	34-40	4-13,500

Preoperative Interactions

A truthful, but simple explanation of the proposed anesthesia and procedures involved should be presented to the parents, and when appropriate, to the child. Parents should be encouraged to display confidence and cheerfulness since their anxiety may be easily transmitted to the child.

Dietary Restraints

The child's stomach should be empty prior to anesthesia. Clear liquids with glucose may be given up to four hours prior to induction in infants up to age six months, six hours prior to induction from age six months to three years, and eight hours prior to induction after three years of age.

Preoperative Medications

Preanesthetic sedation may decrease anxiety, and anticholinergic medications help dry secretions and decrease vagal stimulation. Barbiturates (pentobarbital, secobarbital) in combination with an opiate (morphine) and belladonna alkaloid (atropine, scopolamine) produce suitable preanesthetic sedation in most children.

INTRAOPERATIVE PERIOD

The operating room should be prepared prior to the child's arrival and all extraneous activity eliminated. Special attention must be paid to proper body position and alignment on the operating room table. The prone position may interfere with chest and abdomen expansion. Therefore, the supine position should be employed whenever possible. If a posterior leg approach is needed, the lateral decubitus position is recommended.

Induction

For induction of anesthesia, most anesthesiologists prefer the inhalation anesthetic agents halothane and nitrous oxide. Halothane is relatively nonirritating and has a fruity odor. An intravenous line is established after induction and provides a ready route for the administration of neuromuscular blocking agents (i.e., succinylcholine, d-tubocurarine, pancuronium) and other medications.

Intubation

Successful intubation requires a knowledge of the anatomic differences between infant and adult. In infants, the larynx is higher and the epiglottis is curved, making a straight-blade laryngoscope preferable to a curved blade. Endotracheal tube placement should be confirmed by auscultation and end-tidal capnography.

Body Heat Regulation

It is difficult for infants and small children to maintain body temperature in cold environments. Heat loss can be minimized by using a warming mattress on the operating room table, heating humidified anesthetic gases, warming the patient's skin with an overhead radiant warmer, elevating the operating room temperature, warming all intravenous solutions, and covering the infant's trunk and proximal extremities with a plastic drape.

As compared to adults, small blood and fluid losses in the infant and child may represent a high percentage loss. Blood loss is assessed by prompt weighing of sponges and measuring suctioned material. The surgeon and anesthesiologist must be aware of the total fluid loss. Standard intravenous therapy for maintenance follows these general guidelines:

4 cc/kg/hr for the first 10 kg
(weight of child),
2 cc/kg/hr for second 10 kg
and 1 cc/kg/hr for additional weight.

For example, a 70 kg child would require a total of 110 cc/hr of D5LR, D5NS, or D51/2NS.

POSTANESTHETIC PERIOD

Extubation in children is frequently done under deep anesthesia in order to blunt the coughing and gagging reflexes. Oxygen by mask is given, vital signs are rechecked, and if satisfactory, the patient is transported to the recovery room. Postanesthetic excitement (emergence delirium) is common but usually passes without intervention. Occasionally, a benzodiazepine or nonspecific reversal agent such as physostigmine is helpful.

Malignant hyperthermia, the abrupt and unexplained rise in body temperature, may occur during the administration of and immediately following anesthesia. The phenomenon occurs in children and adults of all ages, but appears most commonly in young adults over the age of 12. The syndrome seems to be related to a calcium transport abnormality in the skeletal muscle. The incidence of this syndrome has been reported as 1:20,000 to 1:50,000. Continual monitoring of rectal, esophageal or nasopharyngeal temperature, heart rate and EKG in all patients undergoing anesthesia is necessary for an early diagnosis. Treatment with dantrolene has been recommended as specific for this disorder.

The goal of the postanesthetic period is for the child to maintain an adequate airway and reach total consciousness as soon as possible. Delayed recovery of consciousness calls for an evaluation of administered anesthetics, arterial gases, and metabolic blood tests. The basics of pediatric anesthesia must be understood by the podiatric surgeon. It is hoped that the information presented will offer a better understanding of the child who is about to undergo anesthesia.

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