

## Outpatient Pediatric Anesthesia

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THE HISTORY of "outpatient pediatric anesthesia" on the North American continent is as old as the history of surgical anesthesia itself. Indeed, it could reasonably be claimed that the first pediatric patient to have "outpatient anesthesia" for a surgical procedure was Jack—"a Negro boy belonging to Mrs. Hemphill of Jackson, Georgia." On July 3, 1842, Dr. Crawford Long administered ether to Jack for amputation of a toe.<sup>1</sup> Long, a country practitioner, would have performed this operation in his office, and sent the boy home when he had recovered from the anesthetic. In the years since, many children have been admitted to hospital, for periods of days or even weeks, for what we now consider to be relatively minor surgical procedures, operations we readily agree can ideally be performed in an outpatient department. Pediatric surgery without admission to hospital has been advocated for many years; in 1938, Herzfeld<sup>2</sup> reported a series of a thousand pediatric herniotomies, many performed on an outpatient basis. It is comparatively recently, however, that a widespread trend toward outpatient surgery for children has occurred, a trend that can be expected to accelerate as the advantages of such surgery for children are recognized and more facilities become available.

### Advantages of Outpatient Surgery in Children

There are three principal reasons for preferring to operate on children without admission to hospital. Outpatient surgery minimizes emotional disturbance, reduces the risk of nosocomial infection, and reduces the cost of treatment.

As discussed in other parts of this symposium, hospitalization has a psychological impact on the child<sup>3</sup> which varies with age,

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duration of hospitalization, and pre-existing emotional status. A study of post-hospitalization behavior demonstrated that emotional trauma to children can be minimized by performing surgery in an outpatient department.<sup>4</sup> In a well-organized program it should not be necessary to separate parent and child for much longer than the duration of the anesthesia.

Hospital-acquired infections, frequently upper respiratory or gastrointestinal, occur in as many as 17 per cent of pediatric patients admitted for surgical operations.<sup>5</sup> Such infections can be reduced by 50-70 per cent in infants when the operations are performed in the outpatient department.<sup>6</sup> Izant noted that hospitalized children came into contact with an average of 27 hospital employees during a two-day admission. Such wide contacts have implications both in the transmission of infection and in the production of emotional disturbances.

The cost of treatment of the patient and his parents is less when hospital admission is avoided. In one institution it was estimated that, over a two-year period, a saving of \$28,000 was achieved.<sup>7</sup> Outpatient herniorrhaphies performed at a Surgicenter cost \$95 less than before that center was developed, and an analysis of costs for all types of patients treated shows an average reduction of \$135 per patient.<sup>8</sup> The advent of outpatient surgery has, however, caused problems in hospitals whose income is dependent on patient admission, and some insurance companies do not pay outpatient costs. As we recognize the numerous advantages of day care, the organization of our health care delivery systems is being modified to accommodate these changes. Pediatric outpatient programs have proliferated over the past few years, with many investigators reporting highly satisfactory results.<sup>4,6,8,9-14</sup> In our own hospital outpatients for surgery now number more than 3,000 annually, and represent nearly 20 per cent of the anesthesia workload.

### Selection of Patients

Initial selection of the patient suitable for outpatient anesthesia and surgery is made by the surgeon. It is thus essential that anesthesiologist and surgeon have mutually acceptable criteria for the selection of patients. When establishing a program and setting the guidelines for patient selection, it is worthwhile to examine the criteria suggested by Lawrie<sup>15</sup>: 1) there must be nothing that can go wrong afterward; 2) no special postoperative care should be needed—beyond a mother's loving care; 3) no special drugs should be needed; 4) no restraint should be necessary—other than by the child's own initiative.

Certain aspects of patient selection, such as age and physical status, require additional discussion. Infants less than 6 months old are excluded from some outpatient surgery programs, but included by others.<sup>8,9,11</sup> Indeed, in this age group day surgery may be particularly advantageous,<sup>6</sup> if separation from the parents can be minimized. No lower age limits are prescribed in our own program.

The physical status of the patient is another important consideration. Few would recommend that day surgery be limited to patients classified as A.S.A. Group I, but most would extend this facility to some Group II, and occasionally to Group III, patients, provided the condition of each was carefully assessed and treatment as an outpatient would not by itself increase the risk. Patients with such chronic diseases as cerebral palsy, cystic fibrosis, asthma, well-controlled epilepsy, and uncomplicated congenital heart disease are regularly accepted in many outpatient programs. On the other hand, most anesthesiologists consider that children with coagulation disorders, hepatic or renal insufficiency, or diabetes should be considered unfit for day-care surgery.

Many pediatric surgical procedures can be performed in the day-care surgery unit, and most larger pediatric centers agree as to selection of such procedures (table 1). Whether tonsillectomy or adenoidectomy should be performed in an outpatient department is debatable. Many such procedures have been carried out in some centers; in

TABLE 1. Types of Pediatric Surgery Commonly Performed on an Out-patient Basis

General surgery
Herniotomy
Orchiopexy
Frenulectomy
Superficial and integumentary lesions
Sigmoidoscopy
Urology
Cystoscopy
Circumcision
Meatotomy
Ophthalmology
Strabismus correction
Lacrimal duct probing
Ptosis procedures
Chalazion
Examination under anesthesia
Otology
Myringotomy (and insertion of tubes)
Removal of foreign body
Plastic surgery
Otoplasty
Excision of cutaneous lesions
Cosmetic surgery
Dental surgery
Conservation
Oral surgery

other units the risk of postoperative hemorrhage is considered to constitute a contraindication.

The duration of the operation and the need for endotracheal intubation are also factors to consider. Postoperative vomiting, particularly troublesome after operation if the patient is in an outpatient department, is more common after long operations than after short ones.<sup>4,18</sup> All operations should be expeditious commensurate with optimal surgical technique (see table 2). In cases where anesthesia is for prolonged minor surgical intervention, such as for dental conservation, a time limit should be clearly established for the outpatient. In our Hospital, four hours is considered the upper limit for outpatient anesthesia for dentistry.

Endotracheal intubation may be used for an outpatient. The child should remain in the recovery area until the risk of immediate complication has passed. In our unit we detain patients for four hours in the post-anesthesia room when endotracheal intuba-

TABLE 2. Mean Duration of Anesthesia and Operation

	Anesthesia (Min.)	Operation (Min.)
Ahlgren <i>et al.</i> <sup>10</sup> (977 cases)	50	35
Cloud <i>et al.</i> <sup>8</sup> (497 cases)	46	26
Davenport <i>et al.</i> <sup>9</sup> (833 cases)	40	(Not reported)

tion has been used. This is probably an unnecessary length of time, but as almost all of these patients have also had prolonged dental surgery, we consider such a stay advisable. Many centers allow pediatric patients whose tracheas have been intubated to be discharged after 1 hour. The incidence of endotracheal intubation in different series ranges from 17<sup>8</sup> to 45<sup>10</sup> per cent. In our unit, endotracheal intubation is rarely considered necessary, except for dental cases. The very low incidence of complications following intubation in our total patient population, however, suggests that if intubation is skillful and the tube of an appropriate size, the technique is safe for outpatients.

The final consideration in selecting suitable patients for day-care surgery relates to the parents. They should reside within a reasonable distance of the unit, that is, a one-hour driving radius,<sup>17</sup> and should thoroughly understand the procedure and have the capability of, and adequate facilities for, care of the child after operation. Preferably, parents should have expressed a desire to have their child treated as an outpatient. When the decision is made, they must be adequately briefed about what will be required and given written instructions for both pre- and postoperative care.

### Design and Staffing of Surgical Facilities

Because children require special care, it is strongly recommended that the pediatric facilities be separate from adult facilities, although in some cases it may be convenient to share services. A series of broad guidelines

and some pertinent regulations are available in the pamphlet, "Guidelines for Ambulatory Surgical Facilities,"<sup>17</sup> published by the American Society of Anesthesiologists.

Structurally, the building itself should be incorporated into a medical center with all other appropriate pediatric facilities. This will facilitate the admission of the rare patient who, after his operation, is unfit to return home, and will also provide the necessary logistical and professional resources for the outpatient surgery unit. Otherwise, prior arrangements must be made for those patients requiring admission to go to a nearby hospital.

The unit should include a documentation and reception area, with facilities for care of records, processing of consent forms and other administrative functions, and waiting areas for parents and escorts; a preoperative examination and preparation area; laboratory facilities for hemoglobin, urinalysis, and sickle-cell estimations; a "holding area" or preferably a "play area" equipped with suitable toys and books. The latter should be brightly decorated, and provided with music and television, the floor should be carpeted, and cushions for small children and chairs for parents provided.

The operating and recovery rooms should be designed and completely equipped as for inpatients undergoing operations. Emergency equipment for transfusion or cardiopulmonary resuscitation must be immediately available, and the services of a blood bank should be readily accessible. The sterilizing areas, storage, packing, and clean-up areas should be provided separately; alternatively, these may be shared with the adjacent medical facility.

Much pediatric outpatient surgery is presently performed in the main hospital operating rooms. While this practice avoids duplication of facilities, it fails to exploit the full advantages of keeping the child separated from the inpatient environment, and simultaneously cutting costs. When day-surgery operating rooms are designed as a part of a large surgical center they should be entirely separate from the main surgical suite.<sup>18</sup>

Physicians staffing an outpatient surgery unit should be equal in caliber to those

servicing inpatients, and be subject to continuing peer review. Anesthesiologists should be appointed with due regard to the old saying "There is no such thing as a minor anesthetic." A physician must always be in attendance in the outpatient surgical unit while patients are present.<sup>17</sup> Adequate numbers of registered nurses must be available for the preoperative areas, operating rooms, and recovery rooms. The nurses should be specialists in the particular type of service to which they limit their activities. Clerical and housekeeping staff will be required as dictated by the size of the facility.

#### Preparation of the Patient for Surgery

Preparation of the patient for operation commences in the surgeon's office as soon as the operation is scheduled, and consists principally in preparation of the parents. Clear, concise written instructions must be provided. Parents are advised to inform the child old enough to understand of the reason for the visit to the outpatient center. He should be told that he will undress, put on pajamas, and go to sleep for the operation so that he will feel no pain. The older child may inquire in some detail as to the planned procedure, and advice as to what to tell him should be given the parents. A frank discussion between parent, child, and anesthesiologist will often help to reduce emotional strain for both the child and his parents.<sup>19</sup>

In addition, specific written instructions about preoperative food and fluid restrictions should be provided. These are the same as those applied for inpatients. It has been recommended that a form be signed by the parent to certify that these restrictions have in fact been observed.<sup>20</sup> In many outpatient programs it appears that preoperative fasting is more effectively imposed by parents than by the staff of the average pediatric surgical ward! The parent is requested to bring a clean, fresh specimen of the child's urine collected on the day of operation. If the child should develop an infection, cough, cold, or fever, the parents are asked to inform the surgeon prior to bringing him to the unit.

On arrival at the outpatient surgical unit, after documentation and completion of the

consent form, the child and mother are seen together by the anesthesiologist in the examining room. The child's history is recorded, together with an examination adequate to assess his ability to undergo anesthesia. Results of hemoglobin estimation, sickle-cell preparation (if applicable) and urinalysis are checked, and any further explanations to the child deemed necessary are made at this time. He is now allowed into the play room until time for his operation.

Pharmacologic premedication should be minimal in the pediatric outpatient, and with a kind approach it will seldom be necessary. For patients having repeated procedures and those likely to become apprehensive, a mild tranquilizer is prescribed, to be administered by the mother before bringing the child to the hospital. Diazepam suspension, 0.2-0.4 mg/kg, given orally, has been found useful; however, it must be made quite clear to the parent that this is the only oral intake allowed! Once the child is in the unit, atropine may be administered parenterally if an inhalational induction is planned, although unfortunately such painful injections disturb many children. Atropine may be administered orally, preferably an hour before operation, but its vagolytic effect when given by this route is less certain.<sup>21</sup> If an intravenous induction is planned, atropine should be administered mixed with the induction agent in the same syringe. This is the preferred practice in our unit. All children should be given a vagal blocking agent prior to, or simultaneously with, induction of anesthesia.

#### Anesthetic Techniques for the Pediatric Outpatient

Anesthetic techniques should be safe, as pleasant as possible for the child, and provide good operating conditions for the surgeon. The techniques used should ensure rapid recovery and minimum of postanesthetic morbidity.

At present, halothane is the inhalation agent most often used for maintenance of anesthesia in children undergoing outpatient surgery.<sup>4,7-10,16</sup> It is the nearest to the ideal presently available for children of all ages. Hepatic sequelae of halothane, if they occur at all in children, are extremely rare.<sup>22</sup> The

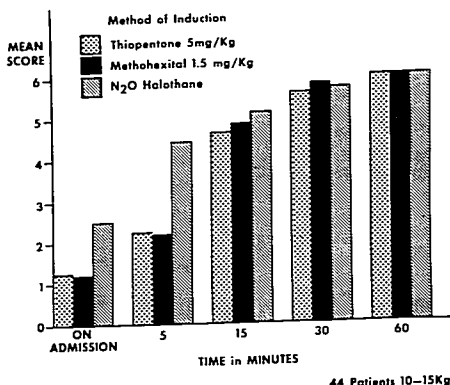


FIG. 1. Recovery from anesthesia using various induction techniques. Duration of operation was  $20 \pm$  minutes. Maintenance agents were halothane and nitrous oxide. A score of 6 indicates full recovery from anesthesia.<sup>21</sup>

agent provides smooth induction, an easily controlled level of maintenance anesthesia, and suitably rapid recovery. Postoperative nausea and vomiting occur less often than with methoxyflurane<sup>23</sup> or isoflurane.† Halothane produces no excitatory phenomena, as does enflurane, and is more pleasant to inhale than either isoflurane or enflurane. Although recovery following enflurane is slightly more rapid than that following halothane, the time advantage is too small to outweigh the disadvantages of enflurane, which are the relatively high incidence of excitatory phenomena, loss of appetite, and bad dreams.†

Nitrous oxide is commonly used with halothane, and in some series has been used in combination with muscle relaxants as the principal agent. When succinylcholine is administered to pediatric outpatients it should be preceded by a small dose of *d*-tubocurarine (0.05 mg/kg) or gallamine (0.2 mg/kg) to avoid postoperative muscle pains, which have been shown to occur in young children.<sup>24</sup> If a nondepolarizing neuromuscular drug is given preceding succinylcholine,

the dose of the latter drug should be increased by 70 per cent to ensure optimal conditions for endotracheal intubation.<sup>25</sup>

Ketamine has been used for anesthesia for outpatient surgery, but prolonged recovery times have led anesthesiologists in many centers to avoid its use.<sup>26</sup>

While induction of anesthesia in outpatient pediatric cases is most frequently by inhalation, a skillfully performed intravenous injection may be less disturbing to the child.<sup>3,27</sup> It is disappointing that so many anesthesiologists regularly order painful intramuscular injections of atropine for their pediatric patients, but ignore the opportunity to provide a painless and relatively pleasant intravenous induction. It might be considered that intravenous agents, particularly barbiturates, should be avoided in the outpatient in order to ensure rapid recovery from anesthesia. Recovery times were studied in children in whom anesthesia was induced either by an inhalation agent or by thiopental, 5 gm/kg, iv, or methohexital, 1.5 mg/kg, iv. Although the group having inhalational induction recovered slightly faster during the first 15 minutes, by 30 minutes there was no difference among the groups. (see fig. 1). Studies of the same groups of patients and their recovery to normal status and normal appetite at home demonstrated no dif-

† Horne JA, Ahlgren EW: Halothane, enflurane, and isoflurane for out-patient surgery: A pediatric case series. Abstracts of the annual meeting of the American Society of Anesthesiologists, Park Ridge, Ill. 1973.

ferences.<sup>4</sup> Thus, in our outpatient unit we prefer to use intravenous induction. Thiopental or methohexital is administered with a 27-gauge needle, with needle and syringe kept out of sight, while distracting the child. Veins on the dorsum of the hand are preferred, and injections are never given into the region of the antecubital fossa, where serious complications may follow a wrongly placed injection.

Whether it is beneficial for the child to have his parent present during induction of anesthesia has been studied, with conflicting results. One study<sup>28</sup> appeared to show that children whose parents were present during induction suffered less emotional disturbance. Other investigators<sup>29,30</sup> have failed to demonstrate such benefit, and concluded that children were more upset when the parent was present. The latter results support the strong clinical impression of many pediatric anesthesiologists that the presence of a parent is disadvantageous and may introduce problems. We do not allow parents to be present during induction of anesthesia.

No discussion of techniques of anesthesia for the outpatient would be complete without a reference to local and regional analgesia. While not as widely applicable to the child as to the adult, this may be successfully employed in the older child. Such a method, however, is of no advantage if heavy sedation is needed to supplement it. Well-conducted general anesthesia results in a more wide-awake child ready to go home.

#### Postanesthetic Management And Assessment of Recovery

The post-anesthetic recovery room (PAR), staffed with suitable numbers of trained nurses, is essential. Patients should be transferred to the PAR on a tilting trolley in the semi-prone position. All patients are given oxygen by mask. Vital signs are charted by a nurse on admission to the PAR and at progressively increasing intervals, and the use of a suitably simple "post-anesthesia recovery scoring system" (table 3) is recommended.<sup>31</sup> Patients may be detained in the PAR for various lengths of time, depending on the type of anesthesia and the nature

TABLE 3. The Simplified Post-anesthetic Recovery Score System\*

Consciousness	
Awake	2
Responding to stimuli	1
Not responding	0
Airway	
Coughing on command or crying	2
Maintaining good airway	1
Airway requires maintenance	0
Movement	
Moving limbs purposefully	2
Non-purposeful movements	1
Not moving	0
TOTAL SCORE	—

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TABLE 4. Mean Duration of Stay in Post-anesthetic Room

	Time to Discharge (Min.)
Ahlgren <i>et al.</i> <sup>10</sup>	
All cases	102
Halothane	124
Nitrous oxide/d-tubocurarine	111
Ketamine	160
Cloud <i>et al.</i> <sup>6</sup>	
All cases	71
With endotracheal tube	
Age less than 1 year	63
Age more than 1 year	77
Without endotracheal tube	
Age less than 1 year	62
Age more than 1 year	78
The Hospital for Sick Children, Toronto	
Without endotracheal tube	60
With endotracheal tube	240*

\* See text.

of operation. Average durations of stays of outpatients in the post-anesthesia rooms are listed in table 4.

Analgesics are given in the post-anesthesia room, depending on the nature of the operation and the response of the child to pain. Until the child is awake, the presence of parents can do little good, and might be undesirable. As soon as he is awake the

parents should be allowed to sit by the child until he is ready for discharge. A fretful child in the post-anesthesia room may respond to being nursed by his mother as well as he will to analgesics or sedatives. In many cases no analgesia is required because the particular procedure produces little postoperative discomfort. Indeed, of 497 patients in a series treated at the Surgicenter in Phoenix, 73 per cent were reported to have not required analgesic drugs.<sup>8</sup> The remainder were given meperidine (Demerol), acetaminophen (tylenol), or acetylsalicylic acid. While meperidine may be given in a dose of 1 mg/kg/body weight for severe pain,<sup>9</sup> the anesthetist/surgeon should ascertain that pain is, in fact, the cause of the child's distress. In our unit the most frequently used analgesic, given intramuscularly in doses of as much as 1.5 mg/kg/body weight, is codeine phosphate. While it is desirable to treat postoperative pain, it must be remembered that all analgesic drugs contribute to drowsiness and postoperative nausea and vomiting.

The decision as to when a child is ready to be sent home may be difficult. Objective assessments suggested for the adult<sup>22</sup> are not applicable to the young child. Certainly, the child must have reached the maximum score on the recovery scoring system, he must appear fully awake, and must have no evidence of complications from surgery or anesthesia. Every child should be examined by the anesthesiologist before he is sent home, and a note about his discharge condition made on the chart.

Every child, whatever his age, must have an escort home. The journey preferably should be by private car or taxicab, and the escort should not be the driver of the automobile. The parents should be provided with written instructions as to the home care of the child, and be provided with a telephone number to call for further advice or to report complications. Such service is essential in the outpatient unit.

A most important aspect of the postoperative management at home is to ensure that the child drinks sufficient fluids. Parents should be instructed to encourage him to drink small amounts often. Unfortunately, nausea and vomiting following outpatient surgery are commoner in children than in

adults. In one series of 408 adult outpatients, postoperative vomiting occurred in 3.9 per cent.<sup>16</sup> In children, however, rates of 21,<sup>9,10</sup> 11,<sup>8</sup> and 15 per cent<sup>4</sup> have been reported; these rates are similar to those previously recognized in inpatients.<sup>23</sup> Fluids such as ginger ale (preferably not too fizzy) or other soft drinks as fancied by the child may optimally be offered. "Popsicles" or similar frozen sweets are well-accepted by the child with a sore throat and constitute a good source of fluid. Nausea and vomiting, no matter when in the postoperative phase they occur, delay the return to normal appetite at home. In such cases, in which fluid management might be a problem, appropriate antiemetic drugs, such as Dramamine, 2 mg/kg, intramuscularly or rectally, should be administered.

### Complications

Complications serious enough to necessitate admission to the hospital are rare. Admission rates in published series range from 0.2 to 5 per cent. In our own program, over the past three years, only nine of more than 8,500 children anesthetized as outpatients have required admission. The commonest reason was anesthesia exceeding our arbitrary maximum limit of four hours. In other series,<sup>9,10</sup> reasons for admission have been croup, bleeding after circumcision or tonsillectomy and adenoidectomy, drowsiness, and excessive vomiting.

Minor morbidity following outpatient surgery has been the subject of several studies.<sup>4,9,10</sup> Nausea, vomiting, and both together are common complications in all reported series. Loss of appetite affects an even greater number of patients, on the day of operation, 31<sup>4</sup> to 38 per cent,<sup>10</sup> and on the day following it, 17 per cent.<sup>4</sup>

Sore throat is a common minor complaint even when endotracheal intubation has not been performed.<sup>34</sup> In a series of 977 pediatric patients reported, of whom 45 per cent were intubated, the overall incidence of sore throat was 41 per cent.<sup>10</sup> In our series the incidence was 8.5 per cent in 206 patients without endotracheal intubation and 59 per cent in patients whose tracheas were intubated. The use of an oropharyngeal airway also increases

the incidence of sore throat, which occurred in 24 per cent of patients with airways and only 6 per cent of those without.

Headache, a recognized sequel of halothane anesthesia, occurred in 12.7 per cent of adults having outpatient anesthesia.<sup>25</sup> The reported incidences in children have been 13<sup>19</sup> and 12 per cent.<sup>4</sup> Muscle pains occur in children if succinylcholine is not preceded by a nondepolarizing neuromuscular blocking agent. The lower age limit for this phenomenon is unknown, because many children are too young to complain. Among our patients histories of post-operative muscle pains were elicited from children as young as 5 years old, and the overall incidence of muscle pains was 46 per cent following the use of unmodified succinylcholine in a group of outpatients, aged 7-18 years.

Thus, it can be said that while the incidence of serious complications in a collected experience of pediatric outpatient surgery is very low, minor morbidity is relatively common. If parents are warned of these problems, they are not alarmed when they occur and will manage them as required.

Parents accept day-care surgery programs very well. Positive reactions elicited in various studies range from 97.5<sup>9</sup> to 99 per cent.<sup>13</sup> When unfavorable responses are elicited from parents, the cause is usually lack of adequate briefing of the parents or unwise selection of the patient (or his parents) as suitable to include in an outpatient program.

### Medicolegal Implications of Outpatient Anesthesia

As the use of outpatient anesthesia increases, it is inevitable that malpractice suits will be initiated. Indeed, the potential medicolegal implication of an outpatient program may exceed those in the hospital proper.<sup>26</sup>

To minimize the possibility of litigation over outpatient anesthesia, the following safeguards should be instituted.

1) The operating room and ancillary facilities in the day-care suite must equal those in the inpatient area.

2) Patients must be selected carefully to ensure that the outpatient status in no way affects the overall risk of the procedure.

3) Patients (or their parents) must be adequately advised and provided with written instructions covering both preoperative and postoperative periods.

4) Patients must be carefully examined preoperatively, and a complete history taken. Proper consent must be obtained.

5) A high level of anesthetic care must be available, and suitable techniques that will ensure rapid recovery must be employed.

6) Patients must be fully examined by the anesthesiologist before being sent home, and the results recorded.

7) A follow-up service must be provided. Following the above guidelines will help to avoid the possibility of lawsuit, and provide a high level of patient care!

Experience with legal matters related to the practice of outpatient anesthesia is limited. In those few suits which have been successfully raised, inadequacies in patient preparation and assessment, operating room facilities, or technique selection were significant factors.

### Summary

Because of the increased trend toward performing a wide variety of pediatric surgical procedures in the outpatient department, the anesthesiologist must appreciate the potential advantages and disadvantages of such a program, and participate in its development. Facilities and standards of care in an outpatient surgery unit must equal those in an inpatient service. Patients must be carefully selected. Anesthetic techniques that ensure rapid recovery and minimum anesthetic morbidity should be used. Facilities to assist parents in the preoperative preparation and the postoperative care of their child must be incorporated into the program.

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