

Practical Anesthesia Guidelines for Pediatric Daycare Surgery: An Update

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Abstract

Daycare surgery for children is frequent, and recently even children with multiple comorbidities are undergoing increasingly difficult surgeries on a daycare basis. Compared to an overnight stay, in daycare surgery, the advantages for the child and their parents/caregivers are less interference with their regular routine, minimal emotional and psychological impacts. Daycare services are more economical for organizations and increase efficiency, however various crucial elements must be considered to provide top-notch pediatric daycare surgery services. This article addresses the key to a successful daycare surgery which includes a proper infrastructure, acceptable inclusion/exclusion standards, the need for a preoperative evaluation, optimum anesthetic management (induction, airway management, intraoperative monitoring, intravenous hydration, maintenance) and appropriate management of speculated postoperative complications. Even though there are stringent requirements for daycare procedures, the anesthetist must be mindful of handling each case independently.

Keywords: Anesthesia, Daycare, Pediatric surgery

Introduction

In several nations worldwide, the number of daycare surgeries has consistently increased during the last three decades. Patients, healthcare providers, and medical professionals are all experiencing the advantages of daycare surgery. Advances in medical technology, surgical expertise, the introduction of novel anesthetic agents/techniques, and better analgesic treatments have all helped to speed up the process. Patients in daycare surgical facilities receive care that is more tailored to their individual needs, enabling them to go home on the day of the procedure and recuperate in a setting that is comfortable for them. Because there is less time spent in the hospital

and no need for staffing on the weekends or at night, and hence more affordable than inpatient surgery [1-3].

Between 1898 and 1908, James Henderson Nicoll was the first to operate on approximately 9,000 children in Glasgow, Scotland, almost half of whom were under three years old to lower high rates of cross-infection, manage bed shortages, and overcome budgetary restrictions [4]. Daycare surgery is defined as the practice of admitting carefully chosen and prepared patients for a scheduled, non-emergency surgery on the day of the procedure and discharging them within twenty-four hours. In addition to admission, surgery, and discharge all taking place on the same calendar day, this definition mandates that the patient be handled with the goal of same-day discharge from the beginning [5].

Daycare surgery has many advantages, some of which to be emphasized are children spend less time away from their parents, exposes them to less potentially contaminated hospital environments, reduced waiting lists, financial benefits, prevent behavioral issues due to stay in hospital, avoiding disturbed sleep patterns, less disruption of child's home life and absence from school. Nevertheless, there are also certain drawbacks, such as the inability to manage issues like pain, postoperative nausea and vomiting, and complications from surgery [6].

Long wait lists for pediatric elective procedures are a significant issue for a developing nation like India's busy public hospitals because of a lack of beds and operating hours. With the best possible use of the resources at hand, this concept of daycare surgery can address a considerable proportion of these scenarios. Establishing and growing a safe daycare surgery program is necessary to reduce waiting list pressures in India, which accounts for 20% of the global disease burden despite having only 6% of hospital beds worldwide. Although daycare surgery is already being practiced in 50% to 70% of pediatric surgical cases in developed nations, this adaptation is currently absent in developing nations where resource scarcity is apparent. The safety and effectiveness of daycare surgeries in children have been supported by literature from various Western nations, however, data from India is scarce [7-11]. Thus, in this review, we are consolidating the overall measures to follow from an anesthesiologist's perspective for a successful daycare surgery.

Infrastructure for daycare surgery

From admission to discharge, children should ideally receive care in specially created pediatric daycare centers with interdisciplinary teams trained in pediatrics and specialized technology. Preoperative assessment services, which can be utilized to risk stratify patients who might need additional evaluation and optimization before their surgery, must be available [12, 13]. The goals should be to build a relationship with patients and their families, soothe their fears, lower surgical morbidity, cut down on case cancellations and delays, and lower pre-operative care costs [1].

Children receive care in non-specialist hospitals in settings that are primarily for adults, but the standards ought to stay the same. During their stay, every child should have a designated pediatrician, an anesthetist, and a consulting surgeon. Anesthesia should be administered under the supervision of consultants with pediatric lists and up-to-date core competence. At least one member of the care team should be trained in pediatric resuscitation, and all staff members should have had child protection training. When treating children, registered pediatric nurse ought to be involved as well [6,12, 13].

Inclusion and exclusion criteria for day care surgery

Inclusion categories for daycare surgeries can be divided into the patient, procedure, family and anesthetic considerations.

1. **Patients:** Day care surgery can help children with stable chronic diseases or minor systemic diseases, in addition to the healthy majority.

a. **Age:** Although the lower age limit for daycare surgery depends on several variables, it is generally agreed that term babies are suitable candidates for day surgery once they are 44 weeks post-conception. However, each baby must be evaluated separately, considering the available resources, level of experience and most facilities do not perform daycare surgery until 60 weeks post-conception age [14,15].

b. **Cardiac status:** In pediatric daycare, an unidentified heart murmur is a frequent problem. When a child under one year has a murmur, they should always be evaluated thoroughly before surgery because a potentially dangerous cardiac lesion might not be apparent yet. While complex congenital heart disease or heart failure is usually contraindicated for daycare; however asymptomatic, uncomplicated, or repaired abnormalities may be acceptable with antibiotic prophylaxis to avoid bacterial endocarditis [16].

c. **Glycemic status:** Children with inherited metabolic disorders or “insulin-dependent diabetes” may have difficult perioperative glucose control, which makes daycare treatment a relative contraindication [17].

d. **Respiratory tract infection:** Viral infections of the upper and lower respiratory tracts might exacerbate respiratory tract secretions, irritation, and airway inflammation. Even those without a history of asthma and those with respiratory virus illnesses that are clinically restricted to the upper airways experience increased airway reactivity and hyperresponsiveness in the lower airways. Several studies have shown that compared to healthy children, children with respiratory tract infections or those who have just recovered mostly experience airway problems during or after anesthesia. Stimulating the airway increases the risk of mild oxygen desaturation and coughing, as well as more significant problems such as bronchospasm, laryngospasm, and respiratory failure. If a child is considered too sick to undergo anesthesia and surgery, it is advisable to postpone the procedure for three to four weeks especially after upper respiratory tract infection has resolved to provide time for the airway hyperresponsiveness to subside [18, 19].

e. **Asthma:** The overall guidelines for anesthetizing a child with asthma for outpatient surgery are the same as those for inpatient procedures. Prior to surgery, the asthmatic patient must strictly follow their medication schedule. A brief course of steroids starting 24 hours prior to the induction of anesthesia may be recommended for patients who have previously needed systemic steroids, especially if tracheal intubation is necessary, however, nebulization with a short-acting β -agonist prior to surgery could be beneficial. Perhaps the most vulnerable time in these cases is emergence from anesthesia, hence extubation should be timed carefully. An active asthma attack in a child increases the risk of anesthesia, so it is important to carefully consider delaying elective surgeries in these patients until the condition is under baseline control again [20, 21].

Although most patients are included there are certain proven exclusion criteria for daycare surgeries such as difficult airway, active bacterial or viral infection, brittle diabetes mellitus, sickle cell illness, complex congenital heart disease, prolonged surgery lasting more than an hour, and high risk of severe perioperative or postoperative bleeding [22].

2. **Procedure:** Certain laparoscopic procedures and body surface operations are appropriate for day-care. Procedures ought to cause little bleeding, require less than an hour, and not result in postoperative pain that cannot be managed with oral analgesics once the patient is sent home are considered appropriate for daycare surgeries. Given that bleeding is the most feared consequence, there is debate on the appropriateness of daycare tonsil and adenoid surgery [23].

3. **Family:** For day surgery to be successful, the child's and family's social situations are crucial. When their child returns home shortly after surgery, overly worried parents and single parents with multiple children may feel overwhelmed. Families should have access to a phone and transportation so they may return to the hospital if needed, and they should reside close to the hospital (less than an hour's drive) [24].

4. **Anesthetic considerations:** Even with contemporary medications, prolonged anesthesia should be avoided to reduce vomiting issues and postpone recovery. Procedures that are expected to take longer than an hour are arbitrarily excluded from day surgery. Daycare surgery may not be possible due to prior anesthetic issues or an anticipated difficult airway. However, the final decision must be taken by qualified experts [25].

Preoperative evaluation and planning

For an anesthesiologist, evaluating outpatients for surgical operations is a major organizational problem. To enable the anesthesiologist to make knowledgeable judgments regarding patient care, a pre-operative screening system that offers the most accurate, current, and comprehensive information must be put in place. Screening questionnaires can be filled out over the phone or online and patients that are fit for

day-care surgery are identified through this procedure. Those that need more research, optimization, or evaluation by an anesthetic consultant are also noted [26].

A more casual discussion about the procedure and its hazards can be had during the preadmission phase when there is more time for conversation than on the morning of admission. All spoken information ought to be documented so that the child or parents can review it later. Well-informed people are more likely to participate, comply, and find the process satisfactory. To reduce anxiety and improve the service experience for patients and their families, some facilities promote the usage of internet resources like videos. Additionally, more recently there are applications for smartphones and tablets that offer hospital tours emphasizing the services available which can comfort the caregivers [27].

Anesthetic management

Pre-operative fasting and IV fluids

Day surgery requires a short recovery period and has a high turnover rate. Children who drink enough water are typically more obliging and at ease. The “consensus statement on clear fluids fasting for elective pediatric general anesthesia (2018)” states that the ideal duration for fasting are six hours for solid foods and milk (including infant formula), four hours for breastfed babies, and one hour for clear liquids [28].

Although most hospitals follow standard fasting guidelines, operating lists sometimes do not run on time, which frequently results in unintentionally prolonged fasting. A more customized starving plan is made possible by some centers by effective use of staggered intakes. A hydration prompt like "Think Drink" during the theatre team brief may help with hydration, and also may allow nurses to warn anesthesiologists about extended fasting and provide a temporary drink. To reduce fasting times, communication between the ward personnel and the theatre crew must be established and maintained [29].

Premedication

Cutaneous anesthesia with a mixture of lidocaine and prilocaine to make intravenous cannulation easier should be applied before entering the anesthesia room. Additionally, it permits more comfortable cannulation during the milder phases of anesthesia after inhalational induction. Due to their tendency to cause severe surgical sedation, traditional premedicants are inappropriate [30]. The best way to lower preoperative anxiety, postoperative memory, and maladaptive behavior in children having outpatient surgery is to utilize sedative premedication. Oral midazolam 0.5 mg/kg (20 mg maximum) has become the most frequently used premedication. It takes 20 to 30 minutes for its onset of action, and because of its bitter flavor, it works best when diluted in a flavored liquid. Other medications used in conjunction with midazolam are notably ketamine, oral and transmucosal fentanyl. It is unnecessary and has not been proven that routine anticholinergic premedication improves induction circumstances

in older children [31]. Dexmedetomidine, another alpha-2 agonist, is gaining popularity because of its better pharmacokinetic profile [32]. Sometimes a particularly recalcitrant younger child requires last-minute pre-operative medication. Intramuscular ketamine at a low dose (2 mg/kg) with an onset of 3–5 minutes may be helpful after parental consent. There is less incidence of emergence delirium and negligible impact on recovery time. If an older child refuses to cooperate during induction, they should be delayed for additional parent counselling instead of being detained [33].

Anesthetic Induction

For pediatric daycare procedures, induction through the intravenous or inhaled route is appropriate. The primary objective is to provide a seamless, atraumatic induction; the selection is based on the needs of individual child. Encouragement of parental attendance during induction, regardless of the method, can benefit both the anesthetist and the child [34]. Inhalation induction is especially appropriate for children with challenging venous access or for people who are afraid of needles. Sevoflurane is quickly becoming the preferred volatile agent. Sevoflurane has a quick onset of action, a pleasant scent, and does not irritate the airway [35]. Since the development of local anesthetic skin preparations, which reduces the pain experienced while securing an intravenous line, the intravenous induction agents have grown in popularity. Additionally, there is some data to suggest that this is less psychologically upsetting for kids than inhalation techniques. Propofol is appropriate for usage in childcare due to several of its properties, however in a child with an unplanned induction it is typically smooth if a high dose (up to 4 mg/kg) is administered [36].

Airway

In outpatient anesthesia, the airway can be managed in a variety of ways. The endotracheal tube is still the gold standard for a secured airway, but in many circumstances, an anesthetic mask alone is utilized to reduce the risk of airway irritation, however, this requires the anesthesiologist to use at least one hand throughout the procedure. These days, people prefer supraglottic airway devices as they can be inserted without revealing the airway and cause less laryngeal irritation than endotracheal tubes [37].

Intravenous fluids

Adequate hydration is beneficial for both compensating for fluid deficiency and serving as a buffer throughout the recovery phase. In most cases, a balanced salt solution is a suitable intravenous fluid. Since hypoglycemia related to pediatric day surgery is uncommon, glucose-containing fluids are not regularly needed [38].

Anesthetic maintenance

For most pediatric daycare surgeries, maintenance including nitrous oxide, oxygen, and a volatile agent is mostly used. Propofol-based total intravenous anesthesia offers clear benefits for several pediatric day procedures [39]. Outpatients can benefit greatly from the use of regional anesthesia, typically in conjunction with a general anesthetic agent. Even though the promise of postoperative analgesia is the primary benefit and the rationale for its use, a small reduction in the depth of general anesthesia can speed recovery and reduce the incidence of opioid-related side effects in most of these children [40]. When neuromuscular blockade is required in daycare surgeries, it is preferable to use intermediate-acting medications like atracurium or cisatracurium instead of any of the longer-acting non-depolarizers when using muscle relaxants [41].

Postoperative analgesia

Postoperative pain management is of utmost importance in day care surgery wherein if the parents are unable to effectively manage pain with basic measures, no child can be sent home. Numerous studies have found that one of the most frequent reasons for unexpected hospitalization following surgery is inadequate analgesia [42]. Using multimodal approaches that combine basic analgesics with adjuncts for local anesthesia is the cornerstone of pain management in daycare surgical settings. The most used methods in day care surgeries are local anesthesia: topical application, local infiltration; regional anesthesia – caudal, epidural, nerve blocks; parenteral – non-steroidal anti-inflammatory drugs (NSAIDs), opioids [43].

Post-operative nausea and vomiting

It is twice as common in children as in adults and is a major cause of unscheduled hospital hospitalization following surgery. Age >3 years, girls, prior history of postoperative nausea/vomiting, general anesthesia lasting more than thirty minutes, adenotonsillectomy, and use of volatile anesthetics, opiates, or anticholinesterases are the recognized risk factors [44]. Ondansetron (0.1 mg/kg) is most widely used to overcome this issue since it does not cause extrapyramidal side effects and causes no sedation. When treating challenging cases of postoperative nausea/vomiting, dexamethasone (0.1 mg/kg) provides a helpful synergistic effect [45].

Complications and unanticipated admission

Even when every aspect of care has been maximized, some patients will unavoidably experience difficulties that necessitate hospitalization and prohibit them from being discharged to their homes. Sometimes, there may be surgical problems, uncontrollable nausea/vomiting, excessive somnolence, inadequate analgesia, respiratory worsening in children with respiratory tract infections, or failure to take appropriate oral fluids which necessitates unplanned admission. To appropriately and adequately address the

conditions that require hospitalization, the surgical and anesthetic teams must continue adequate follow-up care [46].

Discharge criteria for daycare surgery

The discharge criteria that have been mentioned are stable vitals and state of consciousness, adequate pain management, controlled nausea/vomiting, tolerating adequate oral feeds, voided urine post procedure (especially post caudal block), and a clean wound with no active bleeding [6].

Conclusion

Day surgeries are becoming more common in developing nations, and they should be audited with an emphasis on the quality of care as determined by factors like case selection and cancellation, significant events that occur during and after surgery, postoperative morbidities and their effective management, unexpected admissions, the return of the child to their regular activities, and, finally, parental and child satisfaction.

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