Objective: To assess the safety and adverse events associated with the use of general anesthesia in children undergoing elective dermatologic procedures.

Design: A multicenter retrospective review.

Setting: Children’s Hospital and Health Center, San Diego, Calif, and Northwestern University School of Medicine, Chicago, Ill.

Patients: The study population comprised 269 children and adolescents ranging in age from 2 months to 18 years (881 procedures performed by 6 pediatric dermatologic and laser surgeons).

Main Outcome Measures: The risk of an adverse event occurring during general anesthesia for pediatric dermatologic procedures.

Results: The risk of general anesthesia in elective pediatric dermatologic procedures was low: 90% of patients experienced no clinically relevant complications. The most common clinically relevant adverse effect of general anesthesia was perioperative nausea and emesis, which was noted in 4% of patients. There were no serious life-threatening events noted, and the mortality rate was 0%.

Conclusion: The use of general anesthesia for dermatologic procedures in a children’s hospital setting appears safe, with a low rate of complications.

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METHODS

A retrospective review of the procedures performed by 6 pediatric dermatologic and laser surgeons from 2 institutions was performed. All procedures under general anesthesia performed by B.B.C., L.F.E., and S.F.F. at Children’s Hospital and Health Center, San Diego, Calif; and by J.M.G., A.W., and James Donaldson, MD, at Northwestern University School of Medicine, Chicago, Ill; were selected. A total of 881 procedures in which patients underwent general anesthesia for pulsed-dye laser therapy or excisional surgery were identified. Appropriate institutional review board approval was obtained for review of patient medical charts.
A review and retrospective analysis of the patient records was completed to determine each patient’s demographics including age, sex, diagnosis, and procedure performed. Additional data including American Society of Anesthesiologists (ASA) status, coexisting diseases, history of general anesthesia, the anesthetic induction and maintenance agents, length of the procedure, the type of airway used, and presence of parent during induction were recorded. American Society of Anesthesiologists status were as follows: ASA class I (healthy patient), ASA class II (patient with mild systemic disease), ASA class III (patient with severe systemic disease), ASA class IV (patient with severe systemic disease that is a constant threat to life), and ASA class V (moribund patient who is not expected to survive without the operation). All intraoperative complications of general anesthesia were recorded. An adverse event of bradycardia was strictly defined as a heart rate (HR) lower than 100/min for patients younger than 1 year; HR lower than 98/min for patients 1 year or older and younger than 3 years; lower than 65/min for patients 3 years or older and younger than 15 years; and lower than 60/min for patients 15 years or older. An adverse event of bradycardia was documented according to absolute heart rate, irrespective of clinical relevance. Likewise, an adverse event of hypoxia was documented if the oxygen saturation fell below 90%. Hypothermia was defined as core body temperature lower than 35°C.

Twenty-four–hour postoperative complications were noted. This information was usually obtained by the nurse during routine postoperative telephone call.

More than 30 different pediatric anesthesiologists at Children’s Hospital and Health Center and Northwestern University School of Medicine attended to all patients. Routine preoperative procedures were followed for all patients. Fasting guidelines included abstinence from oral intake of solids for 8 hours, milk for 6 hours, and clear liquids for 3 hours prior to anesthetic induction. Induction of anesthesia and type of airway used varied depending on patient’s age, procedure performed, and anesthesiologist’s preference (Figure 1). Children received an inhalation induction of anesthesia, after which an intravenous infusion was started, and then either endotracheal intubation was performed or a laryngeal mask airway was inserted. Induction agents included halothane, sevoflurane, propofol, ketamine, and nitrous oxide. Maintenance of anesthesia was provided by halothane, sevoflurane, propofol, or ketamine.

RESULTS

PATIENT POPULATION

A total of 881 procedures under general anesthesia were performed on 269 pediatric patients (407 at the Children’s Hospital and Health Center and 474 at Northwestern University School of Medicine). The patients ranged in age from 2 months to 18 years, with a mean age of 59 months (5 years), and 44% of the patients were male (56% female). Of the patients, 90% had ASA class I status, 7% had ASA class II status, 3% had ASA class III status, and 0% had ASA class IV or V status.

SURGICAL PROCEDURES

Of the procedures performed under general anesthesia, 88% were pulsed-dye laser treatments, while 12% were excisional surgical procedures. The most common diagnoses for the procedures were 51% for hemangiomas, 29% for port wine stains, 8% for nevi, 4% for verruca or condylomas, and 2% for pilomatrixomas. Remaining diagnoses included keloids, cysts, granulomas, molluscum, non–port wine stain or “complex” vascular malformations, and angiookeratomas (Figure 2). Twenty-three percent of the procedures were performed on patients undergoing primary induction of general anesthesia, whereas 77% of the cases involved repeated inductions of general anesthesia. A parent was present for the induction of general anesthesia for 49% of the cases.

COMPLICATIONS

The morbidity of general anesthesia was low. Of the cases, 97% were performed without clinically relevant complications. The most common adverse effect of general anesthesia was asymptomatic bradycardic events documented in 9% of cases (19% of patients). However, there was no
significant clinical consequence of these events. Nausea and vomiting was documented in 2% of cases and in 4% of patients, which is a lower rate of nausea compared with other surgical procedures. When the postoperative period was extended to 24 hours, 28 cases of nausea and emesis (3% of cases; 5% of patients) were recorded. Other complications include the following: 7 cases of laryngospasm (0.8% of cases; 1.8% of patients), 2 cases of hypothermia, 1 case of upper airway obstruction, 1 case of aspiration, 1 case of hypoxia, 1 case of excessive thrashing, and 1 swollen intravenous catheter insertion site. Two patients required hospital admission; however, both admissions were unrelated to general anesthesia. One patient was admitted for a bleeding ulcerated hemangioma, and the other was admitted for postoperative care of a concurrent tonsillectomy and adenoidectomy operation. Complications such as cardiac arrest, delayed emergence, malignant hyperthermia, emergence delirium, allergic reaction, or croup did not occur in any of the cases. The mortality rate was 0%.

To our knowledge, this is the largest study examining the use of general anesthesia in elective pediatric dermatologic procedures. The data demonstrate that the use of general anesthesia in elective dermatologic procedures is safe and the risk of complications is low. Of the patients, 90% experienced no clinically relevant complications of general anesthesia. Bradycardia was noted in 9% of cases and in 19% of patients. However, we reported all bradycardic events, as defined strictly by the patient’s heart rate. There were no significant clinical events or consequences of these bradycardic events. The second most common adverse event was perioperative nausea and emesis, reported in only 2% of cases and 4% of patients. Our patients experienced no serious adverse events, and the mortality rate was 0%.

Few other studies in the literature have examined the risks of general anesthesia in children undergoing elective dermatologic procedures. In a retrospective review of the use of general anesthesia for pulsed-dye laser treatment in children, Grevelink et al demonstrated that the morbidity of general anesthesia was negligible. Their study examined 39 patients who underwent 215 treatment sessions under general anesthesia and demonstrated no adverse effects in 76% of patients, and laryngospasm or breath holding was the most common adverse effect seen, with an incidence of 10.0%. In our study, only 7 cases of laryngospasm were noted (0.8% of cases), and our overall complication rate was similar. Of the 7 cases (5 separate patients) of laryngospasm, 6 cases were documented in patients with ASA class I status, while 1 episode of transient laryngospasm was seen in a patient with ASA class II status. The procedures documented in the present study were predominately performed on healthy patients without comorbidity. Therefore, the complications that were documented were primarily seen in patients with ASA class I status. Nonetheless, there was a trend toward higher a complication rate in patients with associated comorbidity; the complication rate for laryngospasm was 1 in 61 procedures ($P = .02$) for ASA class II, while it was 6 in 793 procedures ($P = .001$) for ASA class I.

There are several reasons why the complication rate of general anesthesia in elective dermatologic cases is likely to be low. These include good baseline health status of the patients, short procedural duration, the elective nature of the procedures, and the use of pediatric anesthesiologists. Because this was a retrospective medical chart review, it is possible that other complications were not documented. However, given the standard practice of record keeping by anesthesiologists and nurses of both institutions, clinically significant events would have been documented, and therefore this bias mostly concerns less serious events such as nausea.

Most pediatric patients undergoing dermatologic procedures have good baseline health status and few comorbid conditions. In this study, 90% of the patients had ASA class I, 7% had ASA class II, 3% had ASA class III, and 0% had ASA class IV or V status. Tiren et al demonstrated that the risk of anesthetic complications is closely related to the patient’s preoperative condition. In a prospective study of 40 240 anesthetics administered to infants and children, it was shown that the risk of complications increased significantly with ASA class status and the number of coexisting diseases. In addition, it was shown that the risk of major complications in patients of ASA class I and II status was 3.4% or less. Similarly, in a study examining the frequency of bradycardia during general anesthesia, Keenan et al found a statistically significant higher rate of bradycardia in patients with ASA class III or IV status vs an ASA class I or II status. The ASA guidelines state that the risk of an anesthetic complication for a healthy child is 1:20 000 to 1:80 000 or less. Thus, the healthy nature of pediatric patients undergoing dermatologic surgery under general anesthesia places them at a low risk for complications.

The short duration of most dermatologic surgical procedures also decreases the risk of anesthetic-related complications. In the present study, the lengths of anesthesia were short, ranging from 25 minutes to 4 hours and 25 minutes. It has been demonstrated that the complications of general anesthesia increase significantly in longer procedures. In a study examining the frequency of bradycardia in infants during general anesthesia, Keenan et al showed that the risk of intraoperative bradycardia increased 11% with each additional hour of surgery. The elective and nonemergent nature of dermatologic procedures is yet another factor that greatly reduces the risks of complications associated with general anesthesia. Tiren et al found a 3-fold higher risk of complications associated with emergency surgical procedures vs elective procedures in a study evaluating 40 240 pediatric surgical cases. In addition, while examining the incidence of bradycardia in 4645 infants undergoing general anesthesia, Keenan et al found a statistically significant difference in the incidence of bradycardia in elective cases (1.06%) vs emergent cases (2.66%).

The use of pediatric anesthesiologists in all procedures in this study most likely contributed to the low incidence of general anesthesia-related complications. Although controversial, several studies have shown that the risk of complications in children attended to by pediatric anesthesiologists is lower than those attended to by nonpediatric anesthesiologists.
Many physicians and parents are opposed to using general anesthesia for elective dermatologic procedures in children because of the belief that repeated inductions of anesthesia is associated with an increased cumulative risk. Our study evaluated the risk of general anesthesia in 269 separate patients undergoing 881 individual procedures. A total of 77% of children underwent a repeated induction of general anesthesia with no increase in the complication rate. Therefore, it does not seem that repeated exposure to general anesthesia increases the risk of complications, and therefore this should not be a factor contributing to the reluctance of using general anesthesia in elective pediatric dermatologic procedures.

Most of the procedures (88%) performed were pulsed-dye laser treatments, with the remainder being cutaneous excisional surgical procedures (12%). The depth of anesthesia delivered did not differ dependent on the type of procedure performed. Furthermore, the types of inhalational anesthetics did not differ based on the type of procedure.

In conclusion, this retrospective review suggests that the use of general anesthesia for dermatologic procedures in a children’s hospital setting appears safe. Further larger prospective studies will be required to determine the exact risk of complications.

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REFERENCES