Anesthetic Techniques for Pharyngeal Flap Surgery

Effects on Postoperative Complications

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Objective: To assess the effects of 2 different anesthetic techniques on early complications after superior pharyngeal flap surgery.

Design: Randomized, prospective, single-blind study.

Setting: Large referral hospital.

Patients: One hundred patients undergoing superior pharyngeal flap surgery for the correction of velopharyngeal insufficiency were randomly divided into 2 equal groups to receive either isoflurane or propofol-based anesthesia.

Interventions: Following induction of anesthesia with fentanyl citrate and propofol, patients were randomized to receive either isoflurane or propofol for the maintenance of general anesthesia. The inspired isoflurane concentration and propofol infusion rate were adjusted to maintain a stable depth of anesthesia as judged by clinical signs and hemodynamic responses to surgical stimuli.

Main Outcome Measures: Recovery from anesthesia, recovery from surgery, and early postoperative complications.

Results: The groups were similar in age, weight, height, induction time, surgery time, extubation time, and anesthetic time. The time (mean ± SD) required to achieve a maximal Steward Recovery Score was 7 ± 14 minutes in the propofol group compared with 32 ± 28 minutes in the isoflurane group (P < .04). No significant differences in postoperative patient satisfaction scores, time to first swallow, drinking time, and time to “home readiness” were noted. Overall, 17 patients (17%) developed airway-related complications and 2 of the patients (2%) were accounted as severe. Two patients (2%) bled from the operation site. However, there was no difference in the incidence of postoperative complications between the groups.

Conclusions: When compared with isoflurane administration for maintenance of general anesthesia, propofol-based anesthesia was associated with more rapid mental and psychomotor recovery. However, airway-related complications and “home readiness” were similar between the groups.


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The number of patients who underwent pharyngeal flap surgery for the correction of velopharyngeal incompetence were studied according to an institutional review board–approved prospective, randomized, single-blind study protocol. In all cases, written informed consent was obtained. Patients with a history of recent respiratory tract infection and clinically significant cardiovascular, pulmonary, hematomatologic, hepatic, renal, neurologic, psychiatric, or metabolic disease were excluded from the study. A research assistant, blinded to the patient randomization, collected all perioperative data. No preanesthetic medication was administered and all patients were operated on by the same surgeon.

Upon arrival in the operating room, monitoring equipment was applied and noninvasive blood pressure, electrocardiogram, and arterial hemoglobin oxygen saturation were recorded at 1- to 5-minute intervals throughout the operation. Thereafter, dexamethasone (10 mg) and second-generation cephalosporin antibiotics were administered intravenously.

Anesthesia was induced intravenously with fentanyl citrate, 3 µg/kg, and propofol, 2 mg/kg, in all patients. Tracheal intubation and surgical relaxation was facilitated (using a peripheral nerve stimulator) with an intravenous atracurium. Following tracheal intubation, the lungs were artificially ventilated to maintain the end-tidal carbon dioxide at 32 to 36 mm Hg. Thereafter, patients were randomized to 1 of 2 treatment groups. In the isoflurane group, anesthesia was maintained with 0.5% to 1.2% isoflurane (end-tidal) and 70% nitrous oxide in oxygen. In the propofol group, anesthesia was maintained with propofol infusion, 6 to 8 mg/kg per hour via a syringe pump and 70% nitrous oxide in oxygen. Any increase in mean arterial pressure or heart rate exceeding 20% of the patient’s preinduction “baseline” values was treated by an increase in the inspired isoflurane concentration or propofol infusion rate. Following induction of anesthesia, 10 mL of 2% lidocaine (with adrenaline 1:100,000) was infiltrated into the soft palate and pharyngeal mucous membrane where the pharyngeal flap was to be elevated.

Upon completion of the surgical procedure, complete neuromuscular recovery was confirmed by equal contractions in train of four stimulation with a peripheral nerve stimulator applied on the ulnar nerve. Residual neuromuscular block was reversed with neostigmine methylsulfate, 40 µg/kg, and atropine sulfate, 20 µg/kg, intravenously when necessary, and the maintenance of anesthetics discontinued. Thereafter, the lungs were ventilated with 100% oxygen at a flow rate of 8 L/min until tracheal extubation.

During the perioperative period, the following times were recorded: induction time (the time interval between placing the face mask and start of surgery), extubation time (the time interval between end of surgery and extubation), anesthesia time (the time interval between induction of anesthesia and extubation), and surgical time (the time from the start of surgery until removal of the surgical mouth-gag).

Patient satisfaction was measured using a 2-sided Faces Rating Scale. On one side, graphically presented were 5 faces rated as “Face 0” indicating very happy and “Face 5,” crying. On the reverse side, a 100-mm scale was presented. In children aged 3 to 15 years, the graphic side was used but translated into millimeters for data recorded. In patients older than 15 years, a 100-mm visual analog scale was used, where 0 indicated very happy and 100 the worst imaginable feeling. Measurements were recorded on arrival to the operating room (baseline), after the operation, and at discharge from the postanesthetic care unit (PACU).

Using the Steward Recovery Score (SRS), the research assistant assessed patient recovery on PACU admission and at 15-minute intervals until an SRS of 6 was recorded. Time to total recovery was defined as the time from extubation until patients achieved an SRS of 6. Due to institutional policy, all patients remained in the PACU for at least 1 hour postoperatively.

During the immediate postoperative period and hourly until hospital discharge, the incidence of nausea, vomiting, oral bleeding, drooling, and upper airway obstruction (snoring, stridor, lingual edema, and nasopharyngeal obstruction) was recorded. Similarly, at the same time intervals, swallowing time (time from extubation to swallowing secretions), drinking time (time from extubation to oral fluid intake), and time to “home readiness” (time from extubation to eating) were noted. Postoperative pain was measured by a verbal pain rating scale (0=no pain, 1=mild, 2=moderate, 3=severe pain). Postoperative analgesia was provided by 20 mg/kg of paracetamol syrup or suppositories. The number of analgesic requirements was recorded.

Based on the results of previous studies, a power analysis revealed that 50 patients per group would be required to detect a 12- to 15-minute difference in the times from discontinuation of anesthesia to achieving PACU discharge (SRS of 6).

Data are expressed as mean values±SD. In all cases, normality was assessed with the Kolmogorov-Smirnov test (using the Lilliefors modification). Depending upon the results of the Kolmogorov-Smirnov test, either parametric or nonparametric analyses were performed. Demographic data, patient satisfaction scores, and postoperative analgesic requirements were analyzed and compared using the unpaired t test. The SRS, postoperative pain scores, and the incidence of postoperative complications were compared using the Fisher exact test or χ² test as appropriate. Swallowing time and time to home readiness were analyzed using the Mann-Whitney test. P<.05 was considered statistically significant.

The 2 study groups were similar in age, weight, and height. The number of patients who underwent pharyngeal flap surgery alone or in combination with tonsillectomy was similar between the groups (Table 1). The syndromes and anomalies associated with the patients are depicted in Table 2.

Induction time, surgery time, extubation time, and anesthetic time were unaffected by patient randomization (Table 3). The time required to achieve a max-
mal SRS was significantly shorter in the propofol group (7 ± 1.7 minutes) compared with the isoflurane group (32 ± 28 minutes) (P < .04) (Table 3).

Baseline patient satisfaction scores were similar in both groups (Figure). Although patient satisfaction scores increased significantly from the baseline after the operation and on discharge from the PACU, there was no difference between the 2 groups (Figure).

No difference in time to first swallow was noted (9.0 ± 7.7 hours vs 11.0 ± 8.0 hours for the propofol and isoflurane groups, respectively) (Table 3). Similarly, drinking time and time to home readiness were unaffected by the group affiliation (Table 3). Postoperative pain scores and postoperative analgesic requirement were comparable between the groups (Table 4).

The incidence of postoperative nausea, vomiting, bleeding, and drooling were similar between the groups (Table 5). Upper airway obstruction due to snoring, stridor, lingual edema, and nasopharyngeal obstruction were similarly comparable (Table 5).
Following the surgical creation of a superior pharyngeal flap, depressed ventilatory and nasopharyngeal reflexes due to residual anesthesia may have life-threatening consequences. Thus, we hypothesized that in the context of upper airway surgery, propofol-based anesthesia may have benefit over inhalation anesthesia. The results of this single-blind study suggest that when compared with inhalational anesthesia with isoflurane, propofol-induced and -maintained general anesthesia is associated with faster psychomotor recovery. However, following the surgical creation of a superior pharyngeal flap, propofol-based anesthesia did not decrease the incidence of postoperative complications. This is supported by the fact that the time required to achieve a maximal SRS was significantly shorter in the propofol group. However, extubation time and the time to first swallow were comparable between the groups. Similarly, the incidence of postoperative nausea, vomiting, drooling, and bleeding, and airway obstruction were unaffected by the treatment modality. Patient satisfaction scores, although significantly increased after the operation, were not affected by the type of anesthesia. Finally, drinking time and time to home readiness were similar between the groups.

While the time required to achieve maximal SRS was significantly shorter in the propofol group, the clinical importance of this finding is unclear. An end-tidal isoflurane concentration as low as 0.22% can delay early recovery from anesthesia and therefore may contribute to surgically related complications. Indeed, in a study that compared 4 different palatoplasty techniques, one third of the patients became hypoxic after the operation and anesthesia was considered as an important cause. In our opinion, following pharyngeal flap surgery, surgically related acute airway compromise is of greater clinical significance than the time required to achieve a maximal SRS. Since isoflurane-based anesthesia was not associated with an increased complication rate, the results of our study suggest that following pharyngeal flap surgery, propofol offers no real advantage compared with isoflurane. Furthermore, since acute airway compromise is unpredictable, relatively frequent, and may be life threatening, pharyngeal flap surgery is unsuitable for “fast-tracking.” In addition, due to institutional policy, all patients recovering from upper airway surgery must remain in the PACU for at least 1 hour postoperatively. Thus, we suggest that isoflurane is a safe alternative to propofol for pharyngeal flap surgery.

The results of this study demonstrate that superior pharyngeal flap surgery is associated with a high incidence of postoperative nausea and vomiting (28% vs 44% and 40% vs 48% for the propofol and isoflurane groups, respectively). However, no statistically significant difference was demonstrated between the groups. While both the high incidence of emetic sequelae and the lack of statistical significance are difficult to explain, the etiology of these findings is likely multifactorial. First, pediatric patients are prone to postoperative nausea and vomiting. Second, all patients received nitrous oxide. Third, tonsillectomy is associated with increased postoperative emesis. Fourth, we hypothesize that following pharyngeal flap surgery, gastric dilatation due to blood accumulation in the stomach initiates vagal stimulation of the emetic center of the parvicellular reticular formation. Finally, propofol anesthesia was surprisingly associated with a marginal but statistically nonsignificant decrease in postoperative emetic sequelae. While the antiemetic properties of propofol administration have been well described, the results of our study suggest that following pharyngeal flap surgery, stimulation of the chemoreceptor trigger zone and emetic center are more powerful than the antiemetic properties of propofol. Since the complex act of vomiting involves coordination of the respiratory, gastrointestinal, and abdominal musculature, patients recovering from upper airway surgery are at particular risk for aspiration. Furthermore, the active strain of retching and vomiting may jeopardize the flap and surgical reconstruction, which will result in more bleeding and failure to achieve good operative results. Therefore, to avoid emetic-related complications following pharyngeal flap surgery, the efficacy of other antiemetic modalities should be investigated.

Patients are at greater risk for complications during the early postoperative period. Acute airway obstruction is the most fearful complication and can occur in 10% to 95% of patients depending on the study being evaluated. It is precipitated by edema and swelling of the palate and the tongue caused by the surgical dissection and the mouth-gag. Opiate or benzodiazepine premedication, anesthesia, and opiate-based postoperative analgesics can further compromise the impaired airway by central nervous system depression. Airway obstruction may appear as mild snoring, managed by change in patient position or obstructive sleep apnea requiring oro-pharyngeal airway insertion. Because of the severity of the complication, placement of a nasopharyngeal tube after surgery to maintain nasal airway and admission to a critical care unit is not an uncommon routine. Factors that can predict airway obstruction include the surgeon involved, the patient’s associated medical condition, and the patient’s age, with the first being the most predictive. In our study, all of the patients were operated on by the same surgeon and only 2 patients (2%) experienced severe nasopharyngeal obstruction that required immediate intervention. In 1 case, the flap obstructed the nasal airway and was treated by urgent surgery and release of sutures. The second patient had postextubation glossoptosis and was treated by an oral airway and jaw thrust. The rest of the patients experienced mild airway incompetence such as stridor, snoring, and lingual edema; they either recovered spontaneously or after treatment with corticosteroids. It should be noted that with appropriate surgery, patients were not required to be admitted to the critical care unit and were discharged from the hospital in approximately 24 hours after the operation.

Bleeding from the operation site is a serious complication and can occur in 0.5% to 3.9% of patients. Most bleeding occurs in the first 24 hours and half of patients require reexploration. Furthermore, severe bleeding may further compromise the edematous airway. Postoperative bleeding may be influenced by the physician performing the surgical procedure as well as by the fact...
that the donor site was left open. In our study, there were 2 patients (2%) with bleeding, 1 of whom had partial factor VII deficiency and mild thrombocytopenia. Bleeding ceased after infusion of fresh frozen plasma and tranexamic acid. The second patient had profuse bleeding from the donor site that required surgical revision. Neither of the patients required a blood transfusion.

Our study may be criticized because the providing anesthesiologists were aware of the anesthetic drugs being administered. However, recovery end points and complication rates were evaluated in a blinded fashion. A second criticism of this study is that the oxygen saturation (as measured by pulse oximetry) values were not recorded postoperatively, although all the patients were monitored with pulse oximeter for the first 24 hours after their operation.

In conclusion, when compared with isoflurane administration for the maintenance of general anesthesia, propofol-based anesthesia was associated with more rapid mental and psychomotor recovery. However, the incidence of airway-related complications as well as home readiness was similar between the groups. Thus, the incidence of early postoperative complications after pharyngeal flap surgery is not influenced by isoflurane anesthesia or propofol-based intravenous anesthesia.

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