ECONOMICS

Anesthesiology
1999; 91:253-61

Recovery Profile, Costs, and Patient Satisfaction with Propofol and Sevoflurane for Fast-track Office-based Anesthesia

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Background: **Office-based surgery is becoming increasingly popular because of its cost-saving potential. Both propofol and sevoflurane are commonly used in the ambulatory setting because of their favorable recovery profiles. This clinical investigation was designed to compare the clinical effects, recovery characteristics, and cost-effectiveness of propofol and sevoflurane when used alone or in combination for office-based anesthesia.**

Methods: **One hundred four outpatients undergoing superficial surgical procedures at an office-based surgical center were randomly assigned to one of three general anesthetic groups. In groups I and II, propofol 2 mg/kg was administered for induction followed by propofol 75–150 $\mu g \cdot kg^{-1} \cdot min^{-1}$ (group I) or sevoflurane 1–2% (group II) with N_2O 67% in oxygen for maintenance of anesthesia. In group III, anesthesia was induced and maintained with sevoflurane in combination with N_2O 67% in oxygen. Local anesthetics were injected at the incision site before skin incision and during the surgical procedure. The recovery profiles, costs of drugs, and resources used, as well as patient satisfaction, were compared among the three treatment groups.**

Results: **Although early recovery variables (*e.g.*, eye opening, response to commands, and sitting up) were similar in all three groups, the times to standing up and to be "home ready" were significantly prolonged when sevoflurane-N_2O was used for both induction and maintenance of anesthesia. The time to tolerating fluids, recovery room stay, and discharge times were significantly decreased when propofol was used for both induction and maintenance of anesthesia. Similarly, the incidence of postoperative nausea and vomiting and the need for rescue antiemetics were also significantly reduced after propofol anesthesia. Finally, the total costs and patient satisfaction were more favorable when propofol was used for induction and maintenance of office-based anesthesia.**

Conclusion: **Compared with sevoflurane–N_2O, use of propofol–N_2O for office-based anesthesia was associated with an improved recovery profile, greater patient satisfaction, and lower costs. There were significantly more patients who were dissatisfied with the sevoflurane anesthetic technique. (Key words: Pharmacoeconomics; postoperative nausea and vomiting.)**

OFFICE-BASED surgery is one of the fastest growing venues for elective surgical care because of its cost-saving potential.# In the United States, it is estimated that 3–5% of all surgical procedures are performed in the office setting, and it is anticipated to increase to 15% by the year 2000.[1]** General anesthesia,[2] sedation,[3] and dissociative anesthesia[4] have been used in the office setting. The ability to deliver a safe and effective anesthetic with minimal side effects and a rapid recovery is critically important for office-based surgery, and this practice has been facilitated by the introduction of short-acting anesthetic drugs such as propofol, sevoflurane,

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Received from the Department of Anesthesiology and Pain Management, University of Texas Southwestern Medical Center at Dallas, Dallas, Texas; the Department of Anesthesiology and Critical Care Medicine, Children's Hospital of Philadelphia, Philadelphia, Pennsylvania; and the Department of Anesthesiology, Cedars-Sinai Medical Center, Los Angeles, California. Submitted for publication July 1, 1998. Accepted for publication February 18, 1999. Supported in part by an educational grant from Abbott Laboratories, Chicago, Illinois.

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SMG Forecast of Surgical Volume in Hospital/Ambulatory Settings: Chicago, SMG Marketing Group, Inc., 1996; 1994–2001.

** Health Care Advisory Board: Ambulatory care: The movement of ambulatory surgery procedures to less-intensive settings. Issue Tracking Service project No. 3, 1995.

and desflurane.[5-7] The use of these drugs has allowed patients to achieve the traditionally accepted discharge criteria upon arrival in the postanesthesia care unit (PACU).[8] This has led to the suggestion that it is safe for these patients to "bypass" the more labor-intensive PACU and be transferred directly from the operating room (OR) to the step-down (phase II recovery) unit—a paradigm referred to as "fast-tracking."[8,9]

Proponents of this approach claim that there are overall institutional cost savings because earlier awakening is associated with a reduction in nursing labor costs that more than offset the higher costs of the newer anesthetic drugs; however, other investigators have disagreed.[10-14] Although the clinical effects, recovery characteristics, and costs of propofol and sevoflurane have been examined previously in hospital-based ambulatory surgery facilities, they have not been evaluated in the office setting.[5,12,15] The costs of surgical procedures performed in office and hospital settings are quite different.[3,12,15-17]

Therefore, a randomized, single-blind study was designed to test the hypothesis that sevoflurane would be a cost-effective alternative to propofol for induction and maintenance of anesthesia for outpatients undergoing office-based procedures.

Materials and Methods

This study was performed at an office-based surgical center (Bedford Surgicenter, Beverly Hills, CA) that has a single OR in a suite of offices and an attached room with a reclining chair where patients recover from their procedure. There is one nurse available to admit the patient, assist the anesthesiologist and surgeon during surgery, and care for the patient in the recovery area. After obtaining institutional review board approval and written informed consent, 104 outpatients with American Society of Anesthesiologists physical status I, II, or III who were undergoing superficial surgical procedures lasting 30–40 min were enrolled in this single-blind study. Patients were randomly assigned to one of three anesthetic treatment groups according to a computer-generated random numbers table. Group I received propofol for induction followed by propofol–nitrous oxide (N_2O) for maintenance of anesthesia. In group II, anesthesia was induced with propofol and maintained with sevoflurane–N_2O, whereas group III received sevoflurane–N_2O for both induction and maintenance of anesthesia. Patients with a previous history of severe (or unstable) cardiovascular, respiratory, metabolic, endocrine diseases, alcohol or drug abuse, impaired renal or hepatic function, morbid obesity, or pregnancy were excluded from the study.

Patients were asked to provide a detailed medical history and demographic information, including age, weight, height, alcohol or drug consumption, and any history of postoperative nausea and vomiting (PONV) or motion sickness. Before entering the OR, patients completed baseline visual analog scales (VAS) for sedation, fatigue, comfort, pain, and nausea using a 100-mm scale, with 0 = none and 100 = maximum. Upon arrival in the OR, standard monitoring devices consisting of a noninvasive blood pressure cuff, pulse oximeter probe, and electrocardiogram were placed. The mean arterial pressure, heart rate, and hemoglobin oxygen saturation were recorded during surgery. The inspired and end-tidal concentrations of oxygen, carbon dioxide, sevoflurane, and N_2O were measured continuously with a calibrated infrared gas analyzer and recorded along with the fresh gas flow rates. Hemodynamic and anesthetic variables were recorded before anesthetic administration, at 2-min intervals from induction of anesthesia until 10 min after skin incision, and subsequently at 5-min intervals until the end of the surgical procedure.

These unpremedicated patients received 100% oxygen *via* a face mask for 2–3 min before induction of general anesthesia. In groups I and II, anesthesia was induced with propofol 2.0 mg/kg intravenously, after 2 ml 1% lidocaine was administered intravenously for prophylaxis against injection pain. Anesthesia was maintained with either a variable-rate propofol infusion (75–150 $\mu g \cdot kg^{-1} \cdot min^{-1}$ intravenously) in combination with N_2O 67% in oxygen (group I) or end-tidal sevoflurane 1–2% and N_2O 67% in oxygen at 3 l/min (group II). In group III, anesthesia was induced with sevoflurane 8% and N_2O 67% in oxygen (at 6 l/min) and maintained with sevoflurane 1–2% and N_2O 67% in oxygen (at 3 l/min). The propofol infusion rate (group I) and the inspired sevoflurane concentration (groups II and III) were adjusted to maintain a minimally acceptable depth of anesthesia (*i.e.*, to minimize purposeful movements and maintain mean arterial pressure and heart rate values within 15% of the preinduction baseline values). All patients were allowed to breathe spontaneously *via* a face mask or laryngeal mask airway.

Preemptive analgesia was provided by injecting ketorolac 30 mg intravenously and by infiltration of the incision site with a local anesthetic solution containing a 1:1 mixture of 2% lidocaine and 0.5% bupivacaine before

the start of surgery. The local anesthetic solution was also injected during the procedure as required. Maintenance anesthetics were discontinued 5–10 min before the end of surgery. After applying the surgical dressing, patients were asked to sit up on the OR table, stand up, and walk to the recovery area.

Anesthesia time (from induction of anesthesia to discontinuation of N_2O) and surgery time (from incision to placement of the dressing) were recorded. The times at which patients were able to open their eyes and follow commands (*e.g.*, squeeze the investigator's hand), and were oriented to their name and place/date of birth were assessed by a blinded observer at 1-min intervals. The times to sitting up, standing up, ambulating, and tolerating oral fluids were assessed at 5-min intervals. The duration of recovery room stay and actual discharge times were also recorded. "Home readiness" was determined using standard postanesthetic discharge scoring systems.[18,19] The discharge criteria required that the patients be awake and alert with stable vital signs, be able to ambulate without assistance, and be free of intractable side effects. The VAS for sedation, fatigue, comfort, pain, and nausea were repeated 30 min after the end of anesthesia and at the time of discharge. Side effects were noted during the perioperative period (*e.g.*, purposeful intraoperative movements and postoperative nausea, vomiting, and pain), as well as the requirement for "rescue" medications (*e.g.*, metoclopramide, ondansetron, or hydrocodone/acetaminophen). Antiemetics were administered if patients vomited or if they requested treatment for persistent nausea. A trained interviewer who was blinded to the group assignment contacted all patients by telephone 24 h after discharge to inquire about postdischarge side effects and the need for any therapeutic interventions at home. The patients were asked to rate the maximum severity of nausea during the previous 24 h on a 0 (none) to 10 (worst) verbal reporting scale. In addition, this interviewer read the following structured question designed to assess patient satisfaction with the anesthetic experience on a three-point Likert scale and recorded the patient's response: "How would you rate your satisfaction with the anesthesia provided— highly satisfied, satisfied or highly dissatisfied?"

Cost Analysis

The perspective used in the cost analysis was that of the chief financial officer of an office-based surgical center. The marginal costs of drugs and resources used were calculated based on the actual acquisition costs of the drugs to the center and not based on patient charges (table 1). These included the costs of anesthetic drugs used in the OR and analgesic and antiemetic drugs administered in the recovery area. Drugs and resources that were common to all three groups (*e.g.*, N_2O, ketorolac, electrocardiogram leads, pulse oximeter probes, anesthetic circuits, and suction catheters) were not included. Separate analyses were performed including and excluding the costs of drugs wasted. The costs of sevoflurane were calculated using the following formula[20,21]: (Delivered concentration · fresh gas flow · time · molecular weight · cost of 1 ml)/(2,412 · density of sevoflurane).

Table 1. Basic Cost Assumptions for the Economic Analysis

	Cost ($)
Anesthetic drug costs	
Propofol 200 mg	12.59
Sevoflurane 250 ml bottle	180.00
Lidocaine (50 ml)	0.71
Bupivacaine 0.50% (50 ml)	8.00
PACU drug costs	
Metoclopramide (10 mg)	1.86
Ondansetron 4 mg	24.45
Hydrocodone/acetaminophen	0.50
PACU resources costs	
Emesis management (per episode)	2.50
Nursing labor costs (hourly)	35.00

PACU = postanesthesia care unit.

The costs of resources used in the recovery area for managing and treating postoperative pain and nausea were included in the total costs. At the office-based center, the nurse admitted the patient, ensured that all paperwork was completed, assisted the anesthesiologist during induction of anesthesia, helped the surgeon during the operation, and then provided nursing care during the recovery period. When the patient was discharged from the recovery area, the nurse went home and was paid only for the time spent in the center. Nursing labor costs were therefore based on the actual time spent by the nurse in the center. The total costs of each anesthetic technique were calculated by summing the costs of drugs, nursing labor, and resources used. The efficacy of the anesthetic technique was determined by the percentage of patients who were "highly satisfied" with the anesthetic services provided.

Statistical Analysis

An *a priori* power analysis indicated that 32 patients needed to be enrolled in each group for an 80% chance of detecting a 25% reduction in mean of the total costs

Table 2. Demographic Characteristics of the Three Anesthetic Treatment Groups

	Propofol Propofol–N_2O	Propofol Sevoflurane–N_2O	Sevoflurane Sevoflurane–N_2O
Number (n)	35	34	35
Age (yr)	52 ± 14	50 ± 17	51 ± 15
Weight (kg)	66 ± 14	63 ± 16	69 ± 12
Height (cm)	167 ± 7	165 ± 9	167 ± 10
Male/female (n)	12/23	12/22	14/21
ASA physical status I/II/III (n)	18/10/7	17/9/8	17/13/5
Previous PONV (n)	8	4	5
Previous motion sickness (n)	6	8	5
Type of procedures (n)			
Inguinal hernia repair	12	11	13
Excision breast biopsy (partial mastectomy)	19	15	17
Resection of superficial lesions	4	8	5
Anesthesia time (min)	33 ± 18	40 ± 18	42 ± 20
Surgical time (min)	30 ± 17	37 ± 17	39 ± 19
Propofol (mg)	328 ± 99	147 ± 82	0
MAC-min sevoflurane*	0	61 ± 24	68 ± 12
Lidocaine 2% (ml)	46 ± 13	45 ± 11	52 ± 13
Bupivacaine 0.5% (ml)	22 ± 28	23 ± 10	22 ± 9
Oral analgesics (n)	3	2	3

PONV = postoperative nausea and vomiting.

Values are means ± SD or numbers.

* Sum of end-tidal concentration divided by the MAC value multiplied by duration of time (in min) at that concentration.

for a 1-h anesthetic from $ 44.08 to $ 33.06 at the 0.05-level of significance.[20] For the power analysis, assumptions of the SDs of the costs were taken from previously published data.[11] One-way analysis of variance was used to compare the continuous variables among the three treatment groups. If a significant difference was noted, a Newman-Keuls multiple-comparison test was used to determine intergroup differences. Categorical variables were analyzed using the chi-square test or Fisher exact test as appropriate. A P value < 0.05 was considered statistically significant. Data are presented as mean values ± SD, numbers, or percentages.

Results

The three anesthetic treatment groups were comparable with respect to age, weight, height, American Society of Anesthesiologists physical status, history of PONV and motion sickness, and type of the surgical procedure (table 2). The duration of anesthesia and surgery, the amount of local anesthetic solution injected during the perioperative period, and dosages of analgesics administered in the recovery area were also similar among the three groups (table 2).

The early recovery times, including the time from discontinuing administration of anesthetic drugs to eye opening, following commands, and orientation were similar among the three anesthetic groups. In addition, the time to sitting up did not differ among the three groups. Of interest, 88%, 80%, and 78% of patients in groups I, II, and III, respectively, could sit up on the OR table without assistance, and 73%, 79%, and 61% in groups I, II, and III, respectively, were able to walk out of the OR unassisted within 10 min after surgery. These differences were not statistically significant. However, the time to achieve "home readiness" was significantly longer in patients who received sevoflurane-N_2O for both induction and maintenance of anesthesia. The times to tolerating oral fluids, the duration of the recovery room stay, and the times to actual discharge from the office-based surgical center were significantly reduced in patients who received propofol for both induction and maintenance of anesthesia compared with the other two anesthetic techniques (table 3).

The maximum postoperative nausea scores and the incidence of emesis in the recovery area were also significantly decreased in patients who received propofol for induction and maintenance of anesthesia (table 3). Not surprisingly, the need for rescue antiemetics was significantly reduced in the propofol induction-maintenance group compared with the two groups who received sevoflurane. However, the VAS scores for seda-

Table 3. Recovery Characteristics in the Three Anesthetic Treatment Groups

	Propofol–Propofol–N_2O	Propofol–Sevoflurane–N_2O	Sevoflurane–Sevoflurane–N_2O
Number (n)	35	34	35
Eye opening (min)	6 ± 2	6 ± 3	5 ± 2
Responds to commands (min)	6 ± 2	6 ± 3	5 ± 2
Orientation (min)	6 ± 2	6 ± 2	5 ± 2
Sitting up (min)	14 ± 4	19 ± 19	19 ± 15
Standing up (min)	21 ± 12	20 ± 12	31 ± 24†
Ambulate alone (min)	23 ± 15	22 ± 16	32 ± 24†
Recovered motor function <10 min (%)			
Sitting up	88	80	78
Walking	73	79	61
Time to first oral fluid intake (min)	22 ± 7	30 ± 21*	32 ± 14*
End anesthesia to home ready (min)	21 ± 12	25 ± 21	40 ± 31*†
Arrival in recovery area to discharge (min)	37 ± 13	47 ± 19*	46 ± 20*
End anesthesia to discharge (min)	51 ± 14	62 ± 20*	61 ± 19*
Degree of satisfaction with anesthesia (%)			
Highly satisfied	100	88	70*
Satisfied	0	12	13
Highly dissatisfied	0	0	17*
Nausea VAS score in recovery area (mm)	2 ± 9	14 ± 29	24 ± 35*
PONV in recovery area (%)			
Nausea	3	18	40*
Vomiting	0	15*	17*
Rescue antiemetic	0	15*	29*
Postdischarge nausea and vomiting (%)			
Nausea	3	6	15
Vomiting	0	0	3
Rescue antiemetic	0	0	0

VAS = visual analog scale; PONV = postoperative nausea and vomiting.

Values are means ± SD and percentages. Recovery times were calculated from the end of administration of the maintenance anesthetics.

* $P < 0.05$ *versus* propofol–propofol–N_2O.

† $P < 0.05$ *versus* propofol–sevoflurane–N_2O.

tion, fatigue, comfort, and pain did not differ among the three groups (data not reported).

During the 24-h follow-up period, the incidences of postoperative nausea and vomiting were similar among all three anesthetic groups (table 3). Of importance, patient satisfaction with the anesthetic experience was significantly higher when propofol was used for both induction and maintenance of anesthesia compared with induction and maintenance of anesthesia with sevoflurane (table 3). With the exception of PONV, perioperative side effects were similar in all three treatment groups (table 4). Only one patient complained about the odor when sevoflurane was used for induction of anesthesia. Although 17–35% of the patients had ≥ one purposeful movement in response to the surgical stimulus during the procedure, these "minor" movements did not interfere with surgery, and none of the surgeons expressed dissatisfaction with the anesthetic techniques used (table 4).

In this study, the costs of anesthetic drugs used intraoperatively at the office-based center were not significantly different among the three study groups if it was assumed that no propofol was wasted. However, when the cost of the wasted propofol was included in a more appropriate analysis, the cost of propofol for induction and maintenance was significantly higher. The total drug costs for the propofol-N_2O and propofol-sevoflurane-N_2O groups were also significantly higher than for the group that received sevoflurane-N_2O for both induction and maintenance of anesthesia (table 5). This difference in total costs remained significantly higher in the propofol-sevoflurane group regardless of whether the costs of wasted drugs were factored into the analysis. However, the costs of resources and drugs used in the PACU were significantly lower in the group that received propofol for both induction and maintenance of anesthesia because these patients experienced less PONV and were able to be discharged earlier. Similarly, the costs per completely satisfied

Table 4. Perioperative Side Effects in the Three Anesthetic Treatment Groups

	Propofol Propofol–N_2O	Propofol Sevoflurane–N_2O	Sevoflurane Sevoflurane–N_2O
During the operative period			
Movement	37	35	17
Cough	9	6	9
Bronchospasm	0	0	3
Injection pain	11	3	0
During the recovery stay			
Dizziness	14	12	11
Felt cold	3	15	8
Headache	0	0	6
Bad taste	0	0	3

Values are percentages. There are no significant differences between anesthetic groups.

patient was significantly lower in this anesthetic group.

Discussion

The practice of office-based surgery is predicted to grow rapidly because the comparative costs of surgical care in this setting are lower than at a hospital-based or free-standing ambulatory surgery center.[1,22] The techniques used for office-based anesthesia should be safe, effective, and free of side effects and should permit a rapid return of the patient to preoperative status. In this era of cost containment, the anesthetic technique should also be cost-effective, although anesthetic drug costs constitute only a fraction of total perioperative costs. Propofol and sevoflurane have rapid and smooth onsets of action, can be used for both induction and maintenance of general anesthesia, provide highly satisfactory anesthetic and surgical conditions, and have been associated with a short recovery period in ambulatory surgery patients.[5,7,8,23,24] In this study, perioperative analgesia was provided by extensive infiltration of the surgical field with local anesthetics supplemented with intravenous ketorolac. No patient received premedication, opioid analgesics, or muscle relaxants, nor did any require tracheal intubation. The majority of patients were able to walk unassisted from the OR to the step-down recovery area at the end of the surgical procedure.

In this study, the times to ambulation, first oral intake, achievement of discharge readiness, and actual discharge were longer when sevoflurane was used for induction and maintenance of anesthesia. This finding may reflect a deeper level of anesthesia in this group because it was not possible to ensure that patients

Table 5. Incremental Costs Associated with Each Anesthetic Technique at the Office-based Center

	Propofol Propofol–N_2O	Propofol Sevoflurane–N_2O	Sevoflurane Sevoflurane–N_2O
Intraoperative drugs			
Drugs used	20.63 ± 6.23	20.88 ± 7.60	19.34 ± 4.21
Drugs wasted	4.19 ± 3.50	4.82 ± 2.50	0.31 ± 4.19*
Total costs (U.S. dollars)	24.8 ± 6.46	25.67 ± 7.44	19.64 ± 4.18*
Recovery costs			
Additional drugs used	0.04 ± 0.1	1.5 ± 4.23	2.03 ± 4.51*
Resources used	0.1 ± 0.1	0.37 ± 0.9*	0.43 ± 0.97*
Nursing labor costs	21.45 ± 7.49	27.86 ± 11.50*	28.30 ± 11.75*
Total costs (U.S. dollars)	21.49 ± 7.5	29.73 ± 14.00*	30.76 ± 13.03*
Perioperative costs	46.3 ± 11.16	55.41 ± 14.85*	50.10 ± 14.68
Completely satisfied patients (%)	100	88	70
Costs to achieve complete satisfaction in one patient (U.S. dollars)	46.3	62.97*	71.57*

* $P < 0.05$ *versus* propofol–N_2O group.

who received inhalation and intravenous anesthetics were at the same "depth of anesthesia." However, it is likely that the delayed discharge in the sevoflurane group was related to the higher incidence of PONV because there were no differences in the times to eye opening, response to commands, orientation, and sitting up between the three study groups. In addition, there were no differences in the VAS scores for sedation, fatigue, comfort, and pain. The VAS scores for nausea, incidence of emesis, and need for antiemetic rescue therapy were all lower in the propofol induction-maintenance group, consistent with its well-known antiemetic activity.[7,11,25]

Objections have been raised to the widespread use of propofol because of its high acquisition costs.[12,14,15,17,20,25-27] A number of pharmacoeconomic analyses have been performed comparing propofol with the inhalation anesthetics isoflurane and desflurane.[10,12,20,25,26] However, most of these studies suffer from flaws in study design. Some are retrospective studies in which drug costs were calculated from average infusion rates and fresh gas flows.[28] Some studies also failed to take into consideration the amount of drug wasted or the effect of changing fresh gas flow rates on the use of volatile anesthetics. Other studies used a fixed-rate infusion of propofol rather than the usual clinical practice of an adjustable (variable-rate) infusion.[29] In this study, we included the costs of wasted drugs and recorded the actual fresh gas flow rates at 5-min intervals during anesthesia to provide a more accurate estimate of the anesthetic drug costs.

A major problem with many of the early pharmacoeconomic studies is that the investigators only considered the acquisition cost of a drug and not the total costs associated with using a drug, including the costs of managing side effects (*e.g.*, PONV and drowsiness) and their effect on recovery times. Suver *et al.*[10] used a cost-accounting method to determine the total costs of surgery at their health maintenance organization, partitioning costs into those occurring in the preoperative, operative, PACU, pharmacy, and inpatient areas. Both fixed and variable costs were entered into the calculations, including the opportunity costs of nursing labor. Opportunity costs assume that the time a nurse spends with a patient is time away from other activities that will then have to be performed by another person (who will need to be paid for that work). These investigators concluded that propofol was associated with decreased total costs.[10] A similar conclusion was reached by Enlund *et al.*,[14] who used a societal perspective and included costs of social insurance payments for time away from work. In contrast, Boldt *et al.*[12] limited their economic analysis to the acquisition costs of all drugs used during the perioperative period and concluded that propofol was associated with higher costs than the newer inhalation agents.

The inclusion of nursing labor costs in these economic calculations is also controversial. Clearly, some adjustment is necessary because nursing labor costs constitute a major fraction of the total costs in the management of surgical patients.[27] Most anesthesia-related studies have used a linear model in which it was assumed that costs were directly proportional to the time spent in the OR complex, and any time saved was associated with a proportionately decreased cost. This assumption is correct only if the nurses in the PACU take care of one patient at a time, are not present before the arrival of the patient in the PACU, are sent home after that patient is discharged, and are only paid for the time spent working in the center.[30] At most hospital-based centers, nurses are paid a fixed salary for a minimum shift of 8 h, and separate teams of nurses work in the OR and recovery areas. These nurses did not go home after patients were discharged, but rather upon completion of their shift. If discharge was delayed, a new shift of nurses assumed responsibility for the care of the patients. Dexter and Tinker[31] concluded that the major determinant of PACU costs is the peak number of patients admitted to the PACU at any one time, and a reduction in the time to discharge had minimal impact on overall PACU costs.

When the cost-analysis methods described in this study were applied to a similar database from a previously published study[5] using the same anesthetic techniques at a hospital-based ambulatory surgery facility, the reduced incidence of emesis in the propofol-N_2O group was not associated with decreased nursing labor costs ($106.75, $107.33, and $111.58 for groups I, II, and III, respectively). At the hospital-based center, the highest costs of drugs to the institution were in the propofol induction-maintenance group and were significantly greater than the costs in patients who received sevoflurane for both induction and maintenance of anesthesia ($58.86, $49.41, and $44.81 for groups I, II, and III, respectively; $P < 0.05$ for group I *vs.* III). However, the total costs did not differ among the three groups in the hospital setting ($165.86, $157.19, and $111.58 for groups I, II, and III, respectively). Similarly, the costs to account for a completely satisfied patient did not differ between the three groups.

The office-based anesthesia system is different from a

hospital-based ambulatory surgery center. At the center where the study was performed, the nurse could take care of only one patient at a time and in only one place. When the nurse was taking care of a patient in the recovery area, he/she was not available to take care of another patient in the OR. In addition, the nurse went home when the last patient was discharged and was paid only for the time spent in the center. Thus, a 15-min reduction in the time a patient spent in the recovery area was associated with true savings to the office-based center. We also noted that cost savings at the office-based center occurred because of the method used to determine nursing labor payments. If the nurse in the office-based center was paid a fixed salary, the savings that resulted from avoiding a delayed discharge would not be evident unless the additional nursing time resulted in overtime payments to the nurse. In the hospital setting, a reduction in recovery time was not necessarily associated with reduced nursing labor payments unless the nurse received additional time-based payments ("overtime" pay).

Finally, failure to take patient preferences into consideration in pharmacoeconomic analyses may result in inappropriate decisions with regard to drug use. Although patients in this study did not object to the smell of sevoflurane, those who underwent inhalation induction were less satisfied with their overall anesthetic experience. This finding was not noted in previous studies involving induction with sevoflurane in adults and may reflect the different expectations of the patient population served by this private office-based center.[5,24,32] Patients who received propofol for both induction and maintenance of anesthesia experienced less PONV, which may have influenced their overall satisfaction. Patient satisfaction is increasingly used by third-party payers as a benchmark for the quality of care provided, with any rating of less than "excellent" considered undesirable.[33] In this study, we noted that the costs to achieve a completely satisfied patient were lower when propofol was used for both induction and maintenance of anesthesia. The routine use of prophylactic antiemetics in the sevoflurane group may alter these conclusions, depending on the baseline incidence of PONV and the cost and efficacy of the antiemetic used.

In conclusion, this study demonstrates that use of a propofol-N_2O technique for induction and maintenance of anesthesia for office-based surgery was associated with earlier discharge, greater patient satisfaction, and a lower cost-effectiveness ratio compared with techniques using sevoflurane-N_2O for maintenance of anesthesia after either a propofol or sevoflurane induction.

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