

Desflurane does not accelerate recovery from operations of short duration: a practice audit

[Le desflurane n'accélère pas la récupération après une opération de courte durée : un audit clinique]

Michael J. Tessler MD,* Antoine G. Rochon MD,* Ian Shrier MD PhD†

Purpose: Desflurane, a newer inhalation anesthetic agent, has been promoted as a superior drug because patients will awaken sooner after anesthesia. This has only been proven in operations of long duration (i.e., more than one hour). We assessed our experience using desflurane in short out-patient surgery with a retrospective analysis of a single surgeon's elective laparoscopic cholecystectomy patients.

Methods: With Institutional consent, we performed a retrospective comparison of the postoperative recovery of patients who received desflurane/air/oxygen to historical control patients who received isoflurane/N₂O/oxygen.

Results: Patient preoperative characteristics were similar in the two groups. Duration of surgery and the time from the end of surgery to patient leaving the operating room for the desflurane and isoflurane/N₂O groups were (in minutes) 42.7 ± 13.5 and 9.6 ± 4.6 vs 47.2 ± 15.1 and 8.5 ± 4.1 respectively ($P = NS$). Total Aldrete scores upon presentation to the postanesthesia care unit (PACU) were 8.1 ± 1.4 and 7.9 ± 1.8 for the two groups respectively ($P = NS$). The percentage of patients who arrived in the PACU with consciousness scores of 2, 1, 0 for the desflurane and isoflurane/N₂O groups were 20.4, 75.5, and 4.1 vs 14.6, 73.2 and 12.2 respectively ($P = NS$). Mean length of stay in the PACU for the two groups was 160 ± 111 and 156 ± 114 min ($P = NS$).

Conclusion: Our results show that in short procedures the use of desflurane does not necessarily result in faster patient recovery or discharge from the PACU.

Objectif: Le desflurane, nouvel anesthésique d'inhalation, est reconnu comme un médicament supérieur parce qu'il permet un réveil postanesthésique plus rapide. Mais cela ne vaut que pour des opérations de longue durée, c'est-à-dire plus d'une heure. Nous avons évalué notre expérience de l'utilisation du desflurane pour des opérations

de courte durée en procédant à l'analyse rétrospective des cas réglés de cholécystectomie laparoscopique d'un seul chirurgien.

Méthode : Une fois obtenu l'accord de l'institution, nous avons réalisé une comparaison rétrospective de la récupération postopératoire des patients ayant reçu desflurane/air/oxygène ou, dans le cas des patients témoins historiques, isoflurane/N₂O/oxygène.

Résultats : Les caractéristiques préopératoires des patients étaient comparables dans les deux groupes. La durée de l'opération et le temps écoulé entre la fin de l'opération et le départ du patient vers la salle de réveil (SDR) ont été, pour l'utilisation du desflurane et de l'isoflurane/N₂O respectivement, de (en minutes) $42,7 \pm 13,5$ et de $9,6 \pm 4,6$ vs $47,2 \pm 15,1$ et de $8,5 \pm 4,1$ ($P = NS$). Les scores totaux d'Aldrete à l'arrivée en SDR ont été de $8,1 \pm 1,4$ et de $7,9 \pm 1,8$ pour les deux groupes respectivement ($P = NS$). Le pourcentage de patients arrivés à la SDR avec des scores de conscience de 2, 1, 0 pour le desflurane et l'isoflurane/N₂O ont été de 20,4, 75,5 et 4,1 vs 14,6, 73,2 et 12,2 respectivement ($P = NS$). Le séjour moyen en SDR a été de 160 ± 111 et de 156 ± 114 min ($P = NS$).

Conclusion : Nos résultats montrent que l'usage du desflurane pour des opérations de courte durée ne conduit pas nécessairement à une récupération plus rapide ou à un départ plus hâtif de la SDR.

DESFLURANE is advocated to be a superior inhalation anesthetic agent as compared to isoflurane because of its lower blood gas and tissue:blood: partition coefficients.¹⁻⁴ Multiple studies have assessed the benefits of desflurane through prospective, randomized, and/or observational design regarding postoperative psychomotor performance, emergence time, or recov-

From the Departments of Anesthesiology,* Centre for Clinical Epidemiology and Community Studies, and the Lady Davis Institute for Medical Research,† SMBD Jewish General Hospital, McGill University, Montreal, Quebec, Canada.

Address correspondence to: Dr. Michael J. Tessler, Department of Anesthesia, Rm. A-335, SMBD Jewish General Hospital, 3755, Cote Ste-Catherine Road, Montreal, Quebec H3T 1E2, Canada. Phone: 514-340-8222, ext. 5701; Fax: 514-340-8108; E-mail: mtessler@ana.jgh.mcgill.ca

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ery.⁵⁻¹² Unfortunately, in equi-minimum alveolar concentration doses desflurane is significantly more expensive than isoflurane/N₂O.¹²⁻¹⁴ One financial argument supporting the use of desflurane as compared to isoflurane/N₂O, is that patients can recover and be discharged more quickly from the postanesthesia care unit (PACU) and hence improve patient flow.^{12,13} However, previous authors have stated that patients' length of stay in the PACU following desflurane anesthesia was dependent on the duration of the anesthetic.¹² If true, desflurane might not be as advantageous in patients undergoing a short anesthetic exposure (i.e., less than one hour). It is essential that desflurane be proven superior to isoflurane/N₂O in these situations because of the higher cost of the former and the frequency of operations that have short anesthetic exposure. Therefore, the objective of our audit was to compare the recovery time for patients receiving desflurane and isoflurane/N₂O after a short anesthetic exposure.

Methods

With Institutional consent, all the charts of patients who underwent elective laparoscopic cholecystectomy by the same surgeon in 1996 and 1999 were reviewed. Isoflurane was the general anesthetic vapour of choice in 1996 and was used almost exclusively then in our hospital. In part because of studies suggesting more rapid recovery of patients who received desflurane, by 1999 desflurane had become the most commonly used general anesthetic vapour for approximately two years. Therefore, we compared cohort data from patients who received desflurane/air/oxygen (in 1999) to historical controls who received isoflurane/N₂O/oxygen (in 1996). Demographic variables such as patient gender, age, and ASA score were recorded when present. The nursing records were reviewed for the duration of surgery, the time from the end of surgery to leaving the operating room (OR) and total and consciousness Aldrete scores¹⁵ as assessed by the nurse upon the patient's arrival to the PACU and length of stay in the PACU. Intra- and postoperative narcotics, as well as other perioperative analgesic use, were recorded.

Comparison of means was performed using the Student's unpaired t test. The Chi-square test was used to determine whether there was a significant difference between groups for Aldrete consciousness score (categorical variable). In addition, we used multiple logistic regression to control for the potential confounders of age, duration of surgery and delayed transport from the OR to the PACU in a multivariate analysis. Data were analyzed using Statview software

(SAS Institute Inc., Carey, NC, USA) Ninety-five percent confidence intervals (95% CI) are reported where appropriate and the statistical significance was set at a *P* value of 0.05.

Results

One hundred and forty-eight charts were identified. Nineteen charts from 1996 and 34 charts from 1999 were rejected because the inhalation agent used was not charted. Three charts were rejected because a combination of sevoflurane and desflurane was used. Desflurane is administered in an air/oxygen mixture while isoflurane is administered in a N₂O/oxygen mixture in our institution. Forty-one and 51 patients' charts were analyzed for isoflurane/N₂O and desflurane respectively. The two groups were similar in regards to age, gender, ASA scores, the number of treating specialty trained anesthesiologists and the time from the end of surgery to leaving the OR (Table I).

There was no statistically significant difference between the two groups for total Aldrete recovery scores of patients upon arrival in the PACU (*P* = 0.56). Although a higher percentage of patients in the isoflu-

TABLE I Population characteristics

	<i>Desflurane</i> (<i>n</i> = 51)	<i>Isoflurane/N₂O</i> (<i>n</i> = 41)
Age	50.9 (12.7)	52.3 (14.4)
Sex male/female	19/32	9/32
ASA Scores (where recorded)		
I	25	20
II	10	18
III	2	2
IV	1	0
No. of different anesthesiologists	14	12
Duration of surgery (min)	42.7 (13.5)	47.2 (15.1)
Time from end of surgery to leaving operating room (min)	9.6 (4.6)	8.5 (4.1)

Where appropriate, data are expressed as mean (SD).

TABLE II Recovery characteristics of patients

	<i>Desflurane</i>	<i>Isoflurane/N₂O</i>	<i>P-value</i>
Total Aldrete score	8.1 (1.4)	7.9 (1.8)	> 0.5
Mean PACU length of stay (min)	160 (111)	156 (114)	> 0.5
Number of patients (%) with consciousness score			
2	10 (20.4)	6 (14.6)	
1	37 (75.5)	30 (73.2)	
0	2 (4.1)	5 (12.2)	

Where appropriate, data are expressed as mean (SD). PACU = postanesthesia care unit.

rane/N₂O group were admitted to the PACU with a consciousness score of zero, this was not statistically significant in the univariate analysis with consciousness scored as an ordinal variable ($P = 0.3$, Table II). This is true even though, propofol, rocuronium, and ketorolac were used more frequently in the desflurane group. As an exploratory analysis, we combined the semi-conscious and conscious categories but the results were similar ($P = 0.48$). Finally, logistic regression analysis controlling for the potential confounders age, duration of surgery, and delay of transport from the OR to the PACU (note: two desflurane subjects had missing data on delay of transport and therefore $n = 49$ for the desflurane group in this analysis) yielded similar non-significant results (OR = 1.5, 95% CI: 0.48, 4.7).

There was no difference in mean duration of PACU stay between the two groups (160 ± 111 vs 156 ± 114). However, there was an increased incidence of significant postoperative pain (3/5 and higher) in the desflurane group (13/49 vs 1/41, $P = 0.004$). Again, this is true even though the choice and dosage of narcotics were similar for both groups (fentanyl or sufentanil intraoperatively and morphine postoperatively) and the desflurane group received more ketorolac intraoperatively.

Discussion

We undertook this audit to evaluate how desflurane has affected patient care at our institution. We were surprised to find that a balanced anesthetic of isoflurane/N₂O/oxygen as we used it in our usual manner resulted in patients who were as conscious as quickly as those patients who received desflurane/air/oxygen. Further, these patients' overall condition, as judged by the PACU nurse using the Aldrete score, was no different as compared to desflurane for laparoscopic cholecystectomy despite the superior pharmacokinetics of desflurane.

The reasons for this may be in part the short duration of exposure (less than one hour), the concurrent use of N₂O with isoflurane, the long experience using isoflurane/N₂O, and the relative insensitivity of the Aldrete scores. Still, these results reflect our daily practice and show that in specific settings isoflurane/N₂O can result in patients as awake as quickly postoperatively as desflurane.

We think our practice of assessing patients postoperatively is common to many institutions. Specifically, it is the PACU nurse who judges each patient upon presentation and calls the anesthesiologist when he/she thinks the patient is suitable for discharge. Educating the PACU personnel about the advantages of desflurane might encourage quicker PACU dis-

charge, but the patients in the desflurane group in our study had higher pain scores. Patients are not deemed ready for discharge from the PACU until their pain is under control. Further, discharge from the PACU in our institution is dependent upon multiple factors, only one of which is patient readiness.¹⁶

Our study is unique in that we assessed retrospectively the patients of a single surgeon performing a typical short out-patient procedure. We had a natural historical control since desflurane was not available in our hospital prior to 1997 so there was no *a priori* selection bias for the anesthetic vapour selected. We focused on a surgical procedure that was less than one hour in duration. We did not mix surgeons or surgeries and only assessed desflurane after our anesthesiologists had gained sufficient experience using it. Beaussier *et al.* more recently have reported their study of desflurane vs isoflurane.¹² They first prospectively assessed 68 patients for duration of stay in the PACU following either isoflurane/N₂O or desflurane/N₂O anaesthesia. An apparent difference between their results and ours is that in their study patients in the isoflurane group stayed in the PACU longer than patients in the desflurane group. Upon closer inspection of their Figure 1, however, the results of the two studies agree in that when only cases of short duration are assessed (i.e., less than 100 min) Beaussier *et al.* also found no difference between the groups for the length of stay in the PACU.¹² We used a convenient sample of all patients operated over two years (1996 and 1999). Although the study was underpowered to detect a 30-min difference in PACU time (power = 0.41) the actual difference was only four minutes which is clinically irrelevant irrespective of statistical significance. Further, the patients in the desflurane group spent more time in the PACU than the ones in the isoflurane/N₂O group suggesting that a larger sample size would not have qualitatively changed the results.

One weakness of our audit is the large number of patients who were not considered in the analyses because of inadequate documentation. However, given the similarity between the patient characteristics in the two groups (desflurane and isoflurane/N₂O) we do not think there was any difference in the patients who were not included. There is also a question of the accuracy of the data. We think our data is accurate because all times and Aldrete scores were taken from nursing records. No physicians' recorded data was included other than anesthetic vapour used and we rejected all charts where there was any doubt of the vapour used. Another weakness is the retrospective nature of an audit, but this methodology has advantages in that it is representative of routine anes-

thetic practice. Finally, any advances in operating or PACU procedures between the two time periods would be expected to favour the desflurane group, not the isoflurane/N₂O group.

A prospective randomized study would clearly yield stronger evidence. This is not possible in our institution today. First, desflurane is the most commonly used vapour anesthetic used at our hospital and our department has lost the 'feel' for isoflurane/N₂O anesthesia. A study that showed a desflurane based anesthetic resulted in faster awakening in our hospital today might only reflect a poorer quality delivery of isoflurane/N₂O anesthesia. Second, there must be several anesthesiologists involved and delivering both anesthetics. A single practitioner would only reflect one person's practice and this could influence the results.

In summary, we assessed the recovery profile of patients who underwent laparoscopic cholecystectomy under either desflurane/air/oxygen or isoflurane/N₂O/oxygen anesthesia in our institution. Isoflurane/N₂O anesthesia was found to result in patients who were as awake as quickly as desflurane anesthesia. The idea that desflurane anesthesia will result in faster patient discharge from the PACU in the context of a short (less than one hour) anesthetic exposure was not supported.

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