Induction of Anesthesia and Tracheal Intubation with Sevoflurane in Adults

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Background: The speed, quality, and cost of mask induction of anesthesia and laryngeal mask airway insertion or tracheal intubation were studied in young non-premedicated volunteers given high inspired concentrations of sevoflurane (6 to 7%).

Methods: Twenty healthy persons who were 19 to 32 years old participated three times, received 6 l/min fresh gas flow, and were randomized to receive 6 to 7% sevoflurane in 66% nitrous oxide/28% oxygen by face mask until tracheal intubation (treatment 1) or until laryngeal mask airway insertion (treatment 3), or 6 to 7% sevoflurane without nitrous oxide to tracheal intubation (treatment 2). Participants exhaled to residual volume and took three vital capacity breaths of the gas mixture; thereafter ventilation was manually assisted. The time of exposure to the inhaled gas was varied for consecutive participants. It was either increased or decreased by 30-sec increments based on the failure or success of the preceding volunteer’s response to laryngoscopy and intubation after a preselected exposure time. Failure was defined as poor jaw relaxation, coughing or bucking, or inadequate vocal cord relaxation.

Results: Loss of the lid-lash reflex in unpremedicated young volunteers was achieved in 1 min and did not differ among groups. Average time (and 95% confidence interval) for acceptable conditions for LMA insertion was achieved in 1.7 (0.7 to 2.7) min, and all participants had an immediate return of spontaneous ventilation. The time for acceptable tracheal intubating conditions after manual hyperventilation by mask was 4.7 (3.7 to 5.7) min and 6.4 (5.1 to 7.7) min in treatments 1 and 2, respectively. There were no cases of increased secretions or laryngospasm. The incidence of breath holding and expiratory stridor (“crowing”) was 7.5% and 25%, respectively, during treatment 1 and 15% and 40%, respectively, during treatment 2.

Conclusions: The induction of anesthesia to loss of lid reflex in young non-premedicated adults approaches the speed of intravenous induction techniques. No untoward airway responses were noted during mask induction of anesthesia with a three-breath technique. In response to intubation, no adverse airway responses, including jaw tightness, laryngospasm, and excessive coughing or bucking, occurred in participants whose duration of mask administration of sevoflurane met the appropriate times (as determined in this study). (Key words: General anesthesia; Volatile anesthetic; Sevoflurane anesthetic technique; Induction of anesthesia; Mask induction airway complications; Laryngospasm anesthetic costs.)

THE acceptance into clinical practice of the newer potent volatile anesthetics, sevoflurane and desflurane, has been, in part, a function of their low blood/gas solubility that permits more rapid induction and emergence from anesthesia and more rapid control of anesthetic depth. A notable difference between these two new anesthetics is their relative pungency. Sevoflurane’s lack of pungency permits anesthesia to be induced by administering it using a face mask, whereas this is difficult with desflurane because of its extreme pungency. Although the induction of anesthesia using the mask with a volatile agent is common in pediatric patients, sevoflurane’s low blood solubility in combination with its nonpungency make possible mask induction of anesthesia in adults.

Application of the mask induction technique to adult patients will not gain clinical acceptance unless it is well tolerated by patients, the speed of induction approaches that of intravenous agents, and the technique has no untoward airway complications. Thus one objective of this research was to evaluate the speed and quality of anesthetic induction using a face mask when administering maximal inspired concentrations of sevoflurane to adults. In addition, we determined the time required to achieve good intubating conditions when administering only sevoflurane by mask, the time necessary to provide optimal conditions for laryngeal mask

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airway insertion, and the cost of using sevoflurane for induction and intubation.

Finally, we evaluated the benefits of using nitrous oxide in the mask induction procedure. We theorized that the addition of nitrous oxide would provide little benefit to the speed of induction when combined with an anesthetic of low solubility. However, a benefit might be observed in the quality of induction due to the analgesic properties of nitrous oxide. These studies were done in young, non-premedicated adults, in whom the minimum alveolar concentration (MAC) of sevoflurane exceeds that of most adults having elective surgery.\(^{10,11}\)

Methods

We obtained approval from the Institutional Research Review Board and informed consent from 20 healthy persons (ages 19 to 32 yr; 14 men and 6 women) who had no systemic illnesses and were not taking prescription medications or illicit drugs. Each participant was anesthetized on three occasions at least 7 days apart and randomized to receive one of three treatments. Volunteers were instructed to fast for a minimum of 6 h and abstain from using tobacco and drinking alcohol for 24 h before each study.

After ingesting 30 ml sodium citrate, a 20-gauge catheter was placed in an arm vein and fluid deficits were reduced with 5 ml/kg intravenous 0.9% normal saline. Heart rate measured from leads II and V5 of an electrocardiogram (Series 7010; Marquette Electronics, Milwaukee, WI) and mean arterial pressure (MAP; Finapres 2300 noninvasive blood pressure monitor; Ohmeda, Englewood, CO) were continuously monitored. The placement of the Finapres 2300 finger cuff was adjusted so that the MAP measurement was within 10 mmHg of MAP simultaneously recorded from the opposite arm using an oscillometric blood pressure monitor (2120 NIBP Monitor; Ohmeda, Madison, WI). Respiratory movements were monitored with a pneumatic belt placed around the abdomen. Participants breathed oxygen for 5 min (fresh gas flow [FGF], 6 L/min) from a face mask connected to a semiclosed breathing circuit. During this period, baseline data were recorded for 3 min on a strip chart recorder and simultaneously digitized (128 Hz) into a computer for subsequent off-line analysis using custom software.

Immediately before anesthesia was induced, the face mask was removed and placed firmly against the bed linen with an open "pop-off" valve. The FGF of the anesthesiawas machine (Modulus II; Ohmeda, Madison, WI) was adjusted to either 4 L/min N\(_2\)O at 2 L/min O\(_2\) (treatment 1) or maintained at 6 L/min O\(_2\) (treatment 2), and the sevoflurane vaporizer (Penlon model PPV\(_{2}\); Penlon, Abingdon, UK) was advanced beyond the 7% setting to provide maximum sevoflurane delivery. In the reservoir bag was evacuated and allowed to refill. The participant was told during the 30 sec period of circuit priming that the anesthetic has a definite odor but would not be unpleasant to breathe. The face mask was placed over the nose and mouth after a forced exhalation (to residual volume) and the participant took three maximum (vital capacity) breaths, as previously instructed. At the loss of lid-lash reflex, an oral airway was placed and the lungs were manually hyperventilated (ET \(\text{CO}_2\) between 25 and 30 mmHg) with the sevoflurane gas mixture. Pulse oximetry, inspired oxygen, and inspired and expired carbon dioxide, nitrous oxide and sevoflurane concentrations were continuously monitored (RGM 5250; Ohmeda, Madison, WI) and recorded. Gases were sampled from the elbow between the face mask and the Y tubing. Every 30 sec after the loss of the lid reflex, both pupils were examined for position and size. Three min after the first breath of sevoflurane, the FGF was reduced to 3 L/min in treatments 1 and 2. At the preselected times (see below) the face mask and oral airway were removed and laryngoscopy and intubation or LMA placement were attempted. Size 8 or 7 endotracheal tube and size 5 or 4 LMA were used in male and female participants, respectively. The acceptability of placement of the LMA or ET was determined using a grading system modified from Schiller and associates,\(^{12}\) and data are summarized in table 1. To achieve an "acceptable" rating for ET or LMA placement, criteria scores could not exceed 2 for any of the conditions or responses. A single experienced investigator performed the induction and placed the ET or LMA but was blinded to the gas mixture. The occurrence of spontaneous breathing, breath holding, inspiratory stridor, laryngospasm, or secretions was noted when anesthesia was induced. The ability to open the jaw, response to laryngoscopy (coughing or bucking), and the vocal cord position also were recorded. The eyes were examined at 30 sec intervals after loss of the lid-lash reflex, and the time for the pupils to converge to the midline was recorded.

Treatments

The study design sought to determine the duration of anesthesia required to successfully place an ETT or LMA. Three treatments were used:
Treatment 1 (T1): tracheal intubation after anesthetic induction with sevoflurane/66% nitrous oxide

Treatment 2 (T2): tracheal intubation after anesthetic induction with sevoflurane/100% oxygen

Treatment 3 (T3): LMA insertion after anesthetic induction with sevoflurane/66% nitrous oxide.

The duration of ventilation with sevoflurane before airway manipulation was the dependent variable, whereas the delivered anesthetic concentration was fixed (to the maximum limits of the vaporizer). Each treatment trial started with an arbitrary duration of anesthetic exposure before airway manipulation as determined from pilot studies. The initial durations of anesthesia were T1, 5 min; T2, 7 min; and T3, 5.5 min. The outcome of each participant's response to laryngoscopy and intubation or LMA placement determined the duration of anesthesia for the subsequent recipient of that treatment. When the ETT or LMA placement was acceptable (scores in all categories = 2), the duration of anesthesia for the next participant in the treatment group was decreased by 30 sec. Conversely, when the ETT or LMA placement was unacceptable (any score > 2), the duration of anesthesia for the next study participant was increased by 30 sec.

**Statistical Methods**

The "up-and-down" method of Dixon was used to determine the mean and standard deviation of anesthesia duration for acceptable ETT and LMA placement. This is calculated from the midpoints of pairs of the anesthesia duration from consecutive volunteers, where an unacceptable ETT or LMA placement is followed by an acceptable placement. Data are expressed as mean and 95% confidence interval (95% CI = ± 2 SD). The data also were analyzed using Statistical Package for Social Sciences version 4.0 (SPSS Limited, Chicago, IL) for probit test to calculate the effective dose needed to successfully intubate 50% and 95% of subjects for loss of consciousness when appropriate.

**Results**

Figure 1 shows the cumulative concentration of sevoflurane. Mean time for loss of consciousness varied from 1.7 min for each treatment group by an ED50 anesthetized young volunteers. The mean T1, T2, and T3 were 1.0 and 2.0, respectively. The mean ED50 (95% CI) time to loss of consciousness for sevoflurane was 1.7 (0.7 to 7.7) min. The mean T1, T2, and T3 were 1.0 and 2.0, respectively. The mean ED50 (95% CI) time to loss of consciousness for sevoflurane was 1.7 (0.7 to 7.7) min.
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Fig. 1. Inspired and end-tidal sevoflurane concentrations measured at 30-sec intervals during mask administration of sevoflurane from a Penlon model P160 vaporizer. The data represent the average (± SEM) of the measurements from all three treatment groups. Time 0 is the first reading on placement of the face mask. The vaporizer dial was set to the maximum throughout the exposure period (7%), and the fresh gas flow (FGF) was 6 L/min for the first 3 min and 3 L/min thereafter.

Subjects for loss of lid reflex and acceptable intubating or LMA placement conditions. Data were compared among treatments using ANOVA and nonparametric tests when appropriate (StatView 4.02; Abacus Concepts, Berkeley, CA).

Results

Figure 1 shows mean inspired and expired sevoflurane concentrations plotted against duration of anesthesia. Mean time for loss of lid-lash reflex in non-premedicated young volunteers was 1.1 min (95% CI, 0.5 to 1.7 min) for each treatment group. Probit analysis indicated an ED$_{50}$ and ED$_{95}$ respectively, for loss of lid reflex for T$_1$ of 1.1 and 1.6 min, T$_2$ of 1.1 and 1.7 min, and T$_3$ of 1.0 and 1.5 min. Average times for pupils to converge were 4.2 (95% CI, 2.7 to 5.6 min) and 4.8 (95% CI, 2.8 to 6.8 min) for T$_1$ and T$_2$, respectively.

Plots of the duration of anesthesia associated with intubation success or failure for each consecutive participant in each of the three treatment groups are shown in figure 2. The mean (95% CI) times for acceptable tracheal intubation were 4.7 (3.7 to 5.7 min) and 6.4 (5.1 to 7.7 min) for T$_1$ and T$_2$, respectively. The mean (95% CI) time for acceptable LMA insertion was 1.7 (0.7 to 2.7 min). Sixteen of twenty participants maintained spontaneous ventilation before attempted LMA insertion and all had immediate return of spontaneous ventilation after successful LMA placement. The ED$_{50}$ and ED$_{95}$ (from probit analyses) for acceptable conditions associated with ETT or LMA placement were T$_1$ = 4.5 and 6.7, T$_2$ = 6.2 and 7.3, and T$_3$ = 1.6 and 2.5 min.

Table 1 shows the frequencies of acceptable and un-toward airway responses. There were no instances of coughing on induction (before attempted ETT or LMA insertion) with any of the 60 anesthetics. Breath holding occurred in 15% of volunteers breathing sevoflurane/oxygen and occurred in only 7.5% of those breathing sevoflurane/nitrous oxide. The incidence of expiratory stridor (‘crowning’) exhibited any time during mask ventilation was 40% when sevoflurane was delivered in oxygen and 25% when sevoflurane was delivered in nitrous oxide. This did not inhibit mask ventilation, and peak airway pressure during manual ventilation never exceeded 20 cm H$_2$O. No participants experienced laryngospasm, including those who had unacceptable responses to laryngoscopy and tracheal intubation. Typically the vocal cords were in a mid-position (half open) or fully open position at intubation.

Table 2 shows the values for heart rate and MAP at conscious baseline and at the respective times of lowest and highest MAP before and after intubation or LMA placement. Data are shown from participants with ac-

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Fig. 2. The duration of anesthetic exposure for consecutive subjects in each of the three treatment groups is displayed. The determination of acceptable and unacceptable responses to LMA or laryngoscopy and tracheal intubation are defined in the text. The X represents the mean time when crossing from an unacceptable to an acceptable response. The average of the crossings is represented by the horizontal dashed line. T = treatment group as defined in the methods section.
Table 2. Minimum and Maximum Hemodynamic Responses during “Acceptable” Anesthetic Induction and Laryngeal Mask Airway or Endotracheal Tube

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<th>Baseline</th>
<th>Minimum</th>
<th>Maximum</th>
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<tr>
<td>Heart rate (bpm)</td>
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<tr>
<td>T₁ (SEVO/N₂O)</td>
<td>63 ± 2</td>
<td>85 ± 5</td>
<td>110 ± 7</td>
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<tr>
<td>T₂ (SEVO/O₂)</td>
<td>68 ± 2</td>
<td>80 ± 4</td>
<td>130 ± 6</td>
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<tr>
<td>T₃ (LMA)</td>
<td>65 ± 3</td>
<td>84 ± 3</td>
<td>92 ± 3</td>
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<tr>
<td>Mean arterial pressure (mmHg)</td>
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<tr>
<td>T₁ (SEVO/N₂O)</td>
<td>90 ± 2</td>
<td>67 ± 5</td>
<td>101 ± 3</td>
</tr>
<tr>
<td>T₂ (SEVO/O₂)</td>
<td>93 ± 3</td>
<td>66 ± 5</td>
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<tr>
<td>T₃ (LMA)</td>
<td>95 ± 3</td>
<td>75 ± 2</td>
<td>93 ± 6</td>
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Data are mean ± SEM

1”Acceptable” refers to responses to airway stimulation that met criteria as defined in the text and Table 1.
2 Significant change from baseline (Spearman signed rank P < 0.01).
3 Significant change from minimum (Spearman signed rank P < 0.01).
4 Significant difference T₁ versus T₂ (ANOVA P < 0.01).
5 Significant difference T₁ versus T₃ (ANOVA P < 0.01).
6 For HR, measures were taken when BP was minimum.

Acceptable responses to intubation or LMA placement. Significant increases in heart rate from baseline and significant decreases in MAP from baseline were observed before intubation or LMA placement in all treatments. Significant increases in heart rate and MAP from baseline were associated with tracheal intubation (T₁ and T₂) and heart rate only for LMA insertion (T₃). Tracheal intubation was associated with significant increases in heart rate and MAP, and the increase in heart rate was less with nitrous oxide (T₂) than without it (T₁). There was a significant increase in MAP associated with LMA insertion, but MAP did not exceed baseline values and heart rate was unchanged after LMA insertion (T₃).

Discussion

The major findings of these studies are (1) sevoflurane administered by face mask to non-premedicated young volunteers at a concentration of 6 to 7% was not associated with increased airway secretions, coughing, or laryngospasm; (2) loss of the lid reflex was achieved in 1 min and thus approaches the speed of induction obtained with intravenous agents; (3) good conditions for LMA insertion were achieved in 1.7 min with immediate return of spontaneous ventilation; and (4) good tracheal intubating conditions could be achieved without neuromuscular blocking drugs or other adjuvants more quickly if 66% nitrous oxide was combined with sevoflurane (4.7 min) than when sevoflurane was given in 100% oxygen (6.4 min).

A new technique for mask induction of anesthesia with halothane in adults was described in the mid-1980s by Ruffe and colleagues and by Wilton and coworkers. Because of the limitations of a smaller alveolar ventilation rate per kilogram in adults compared with children, these authors modified the technique to hasten loss of consciousness in adults. This was done by filling the anesthetic circuit with a high concentration of the anesthetic gas, placing the mask onto the patient after an exhalation to residual volume, and asking the patient to take a single deep inspiration and hold the breath for as long as possible. The single vital capacity breath (VCB) technique improved the speed of induction when compared with gradually increasing the inspired concentration of the anesthetic gas during tidal volume breathing and reduced the incidence of induction complications, such as coughing, movement, and laryngospasm, by about 50%. The advantages of mask induction of anesthesia in adults were avoidance of apnea, anaphylaxis, hypotension, the "hangover" effect associated with intravenous inductions and venipuncture in anxious conscious patients.

We further modified the single, maintained VCB technique of mask induction to reduce the need for patient cooperation and to avoid the Valsalva maneuver associated with a maximally held inspiration. A potential disadvantage of our three-breath method is a delay return of spontaneous ventilation because hyperventilation is associated with hypocarbia and a reduced ventilatory drive. This did not appear to be a problem in the limb of the study in which an LMA was successfully placed after 2 min. Eighty percent of participants were still spontaneously breathing when LMA insertion was attempted, and all volunteers had spontaneous ventilation immediately after LMA placement. In the other two limbs of the study, ventilation was overridden by design. Hyperventilation to achieve a rapid depth of anesthesia for intubation, thereby minimizing the cost of using sevoflurane.

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To derive the cost of sevoflurane administered via mask to LMA or ET T placement, we applied the formula of Dion (Canad J Anesth 1992; 39:633) for consecutive 30 sec increments using the average delivered sevoflurane concentration (fig. 1). The formula was (PFTMC/2412 d where P = % gas concentration, F = FGE (l/min), T = time (min), M = molecular weight (200 g), C = cost/ml ($1 cents/ml, and d = density (1 505 g/ml). The calculations are based on 6 L/min FGE for the first 3.5 min (including 50 sec to prime the circuit) and 5 L/min FGE thereafter. Treatment 1 = $6.59, treatment 2 = $7.79, and treatment 3 = $3.64.
**Induction Responses**

Because the newest volatile anesthetics have a low blood/gas partition coefficient, mask induction of anesthesia might parallel the speed of intravenous induction. Unfortunately, the pungency of desflurane has seriously limited its use by face mask because of an unacceptable airway complication rate.\(^9\)\(^^{-}\)\(^{23}\) Sevolflurane is nonpungent and has been used by a few investigators with a high degree of success for mask induction of anesthesia.\(^1\)\(^{-}\)\(^{5}\) In earlier studies, sevolflurane was titrated into the inspired gas with few complications.\(^1\)\(^{-}\)\(^{25}\) More recently, the technique of a single VCB was used with sevolflurane.\(^4\)\(^{-}\)\(^{6}\)\(^{-}\)\(^{26}\) In studies on non-premedicated younger volunteers, comparable to our study, loss of consciousness was achieved in 32 patients holding a single breath of 4.5% sevolflurane with 66% nitrous oxide, in a mean time of 54 sec.\(^4\) Two volunteers had movement, two coughed, and none of them had increased secretions, breath holding, or laryngospasm. This work was performed on 19 young volunteers induced with a single VCB of 7.5% sevolflurane in nitrous oxide, and time to loss of consciousness was improved to 41 s.\(^{25}\)\(^{-}\)\(^{27}\) Furthermore, the complication rate was reduced to only one instance of coughing and no cases of movement, secretions, or laryngospasm. The reduced complication rate associated with delivering a higher inspired concentration of sevolflurane may be attributed to a more rapid passage to a deeper plane of anesthesia. These two studies are in contrast to a recent report in which 5% sevolflurane and 50% nitrous oxide were used for a VCB induction of anesthesia after 2 mg midazolam.\(^7\) The authors reported a 24% incidence of airway obstruction and a 28% incidence of laryngospasm (see later comments).

We recorded the time to the loss of the lid-lash reflex as our induction time, and this time averaged 62 sec. In all cases, loss of consciousness occurred before loss of the lid-lash reflex, but the loss of consciousness time was not a recorded variable. Unlike an earlier report of a 7-sec faster time to loss of consciousness when nitrous oxide was added to 7.5% sevolflurane/oxygen,\(^24\) we could not demonstrate an improved speed of induction when nitrous oxide was used in one of our studies. This might be expected based on our study design using repeated vital capacity breaths. The concentrating effect of uptake of the second gas would have been reduced because of repeated replenishment of the alveolar gas with continued breathing. Furthermore, the second gas effect would be expected to be less potent with a poorly soluble anesthetic such as sevolflurane. Consistent with several earlier reports,\(^23\)\(^\)\(^{24}\) our airway complication rate during induction of anesthesia with sevolflurane delivered at 6 to 7% was devoid of laryngospasm, increased secretions, or excessive coughing. We observed a 10% incidence of breath holding during induction of anesthesia. This was not considered a complication because breath holding is self-limited and anesthetic uptake from the alveoli continued during the breath hold, thereby advancing the depth of anesthesia.

**Intubation**

The average time to acceptable intubating conditions was 4.7 min and 6.4 min with and without 66% nitrous oxide, respectively. We tried to achieve acceptable intubating conditions as quickly as possible. Therefore it was impossible to determine the true MAC associated with these induction times because equilibration between cerebral tissue and the blood partial pressure of sevolflurane did not occur. The mask end-tidal concentrations of sevolflurane just before successful tracheal intubations were 5.6 ± 0.1% and 5.1 ± 0.1%, and end-tidal concentrations from the endotracheal tube were 4.4 ± 0.3% and 4.5 ± 0.2% in the sevolflurane/nitrous oxide and sevolflurane/oxygen groups, respectively. Only one previous study examined the concentration of sevolflurane delivered by mask to achieve adequate tracheal intubating conditions.\(^1\) To do this, the investigators maintained fixed end-tidal concentrations for 20 min to increase the likelihood that cerebral tissue had equilibrated with the blood partial pressure. They found the MAC\(_{50}\) (endotracheal intubation) for a 50% response to intubation was 4.52% (2.8 times MAC). The ED\(_{50}\) was estimated to be 8%.

We carefully evaluated eye field responses to relate the convergence of the pupils (gaze) to a midline position with the time for acceptable tracheal intubating conditions. We assumed pupil convergence to represent the end of stage 2 of anesthesia. The time to achieve pupil convergence was slightly faster in the nitrous oxide group (4.2 vs. 4.85 min, \(P < 0.05\)). The time for acceptable intubating conditions occurred less than 1 min after pupil convergence in the sevolflurane/nitrous oxide group and 2 min after pupil convergence in the sevolflurane/oxygen group. The decreased time delay between pupil convergence and acceptable intubating conditions in the nitrous oxide group may be due to the added analgesic effect of nitrous oxide.\(^9\) Our observation that the incidence of mild cough after successful intubation was significantly less in partici-
pants receiving nitrous oxide/sevoflurane (1 of 11) compared with intubation in the volunteers who did not receive nitrous oxide (7 of 11) (Table 1) is consistent with the added analgesic effect of nitrous oxide.

Other complications during intubation in the two groups taken to intubation depth were infrequent. We observed inadequate jaw relaxation and vocal cord separation only once in subjects classified as failing the attempted intubation. In all treatment groups, we observed a high incidence (35 to 40%) of “crowding” or expiratory stridor despite early placement of an oral airway. The frequency of “crowding” was consistent with a preliminary report of mask induction of anesthesia with a single vital capacity breath of 5% sevoflurane/50% nitrous oxide, but the authors defined this event as laryngospasm. We believe this is an incorrect description because “crowding” did not interfere with our ability to apply positive-pressure ventilation and resolved as the anesthetic state was deepened.

We also report other observations that were not central to the research goals. First, there was a 100% acceptance rate for inducing anesthesia using the face mask, and this is consistent with the absence of pungency with sevoflurane. Second, participants recalled only the first two breaths during induction, and those who had unacceptable intubating conditions did not recall any event associated with airway manipulation. Third, the delivered concentration of sevoflurane was less than the dialled concentration of sevoflurane on the Penlon PPR2 vaporizer. We delivered an average of only 6% after the first few breaths from the circuit (fig. 1). This is consistent with an earlier report and can be attributed to limitations of the vaporizer at high F1Gs. Presumably the cooling of the anesthetic during vaporization at high F1Gs limits further rates of vaporization.

A potential limitation of the mask induction technique for tracheal intubation is the hypotension associated with delaying a high concentration of sevoflurane for 4 to 6 min. With the knowledge that the Finares device has certain limitations or inaccuracies for detecting heat-by-heat arterial pressure, we recorded MAPs that averaged 60 mmHg immediately before acceptable laryngoscopy (table 2). Mean arterial pressure decreased to less than 50 mmHg in four participants.

References


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