

Induction Of Anesthesia In Adults By Administering A Volatile Anesthetic Via The Face Mask - A Technique Revisited

*By Dr. Thomas J. Ebert, Department of Anesthesiology,
The Medical College of Wisconsin, and VA Medical Centre, Milwaukee, Wisconsin.*

In the late 1800's and early 1900's, the induction of anesthesia was carried out by administering an anesthetic substance such as nitrous oxide, cyclopropane or ether via the face mask. The patients would inhale the gas through various creative devices designed to deliver these anesthetics with minimal environmental waste. Cyclopropane was an extremely fast acting anesthetic that led to loss of consciousness in few breaths. There were two primary factors that limited the clinical use of both cyclopropane and ether:

1. They were highly flammable agents. Consequently during the use of these agents, sparks, static electricity or electrical current in the OR were capable of triggering an explosion. This necessitated the implementation of strategies to decrease the incidence of explosions, including randomly checking nursing personnel for the presence of nylon clothing.
2. The second limiting factor was the high incidence of nausea and vomiting following the administration of these two gases.

In the 1930's, the anesthetic properties of the barbiturates were first described and one of these, sodium thiopental was shown to produce a quick and short-lived loss of consciousness. For the next two decades, there was an ongoing debate in the anesthesia literature as to whether intravenous or inhalational anesthetic induction was the better method for induction. In the 1950's halothane was introduced into clinical practice. It became quite popular because it was nonflammable and was associated with less nausea and vomiting.

However, its pungency and high solubility (slow onset) limited its use as an induction agent in adults, and intravenous agents became the mainstay for induction of anesthesia in this population. Mask inductions with halothane were reserved for pediatric patients in which a rapid induction of anesthesia could be achieved despite its pungency and high solubility

because of the increased alveolar ventilation rate per kilogram.

In the early 1980's. John Ruffle, M.D., at the Department of Anesthesiology, Hershey Medical Centre in Pennsylvania, described a technique of rapid induction of anesthesia in adults with halothane. With this technique, after a complete exhalation to residual volume, patients would then inhale and hold a vital capacity breath of high concentration (e.g., 3 - 4%) of halothane in oxygen or in nitrous oxide/oxygen. After the breath hold, the subject would resume spontaneous ventilation and loss of consciousness would follow. When administering 4% halothane ($\approx 4\text{MAC}$) via the single breath technique, 75% of patients became unconscious within one minute and 90% had achieved unconsciousness in two minutes. This single vital capacity breath technique was then applied with enflurane, isoflurane and more recently with desflurane. A relationship was noted between the blood: gas coefficient, the quicker the onset of unconsciousness occurred. However, because of the increased pungency of the newer agents compared to halothane, there was higher incidence of airway complications that included excessive secretions, breath holding, coughing, involuntary patient movement and laryngospasm as well as unacceptable patient satisfaction. Thus, the technique of inducing adult patients via the face mask did not gain any degree of popularity.

With the introduction of Sevoflurane in the mid 1990's, a non-pungent, potent, volatile anesthetic was available for the first time to the anesthesiologist. This property, combined with Sevoflurane's low blood:gas coefficient (i.e. insolubility), has resurrected the interest in induction of anesthesia via the face mask. Studies carried out both in Japan and in the United States indicate that when using mask anesthetic single breath inductions with Sevoflurane, loss of the eyelash reflex could be achieved in 60 seconds. The incidence of coughing and breath holding was minimal. Sevoflurane

did not trigger increased airway secretions and there were no reports of laryngospasm. Involuntary patient movement was limited to occasional twitches of the fingers. In the 1930's, the challenge of intravenous induction over the standard inhalation techniques was heavily debated in anesthesia literature. Data supporting the use of sevoflurane, as an ideal inhalation induction agent will no doubt revive the discussion, this time suggesting, that perhaps mask induction of anesthesia with Sevoflurane should replace the standard intravenous induction technique.

To gain widespread clinical acceptance, the induction of anesthesia via the face mask administration of Sevoflurane must be well accepted by patients, equal to the speed of induction using intravenous drugs and not be associated with untoward airway complications. In addition, the cost of mask induction of Sevoflurane should not exceed that of the standard intravenous technique. Recent studies, completed at our institution, explored these issues in healthy non-premedicated volunteers. We asked them to breathe either 6% Sevoflurane in 66% nitrous oxide/34% oxygen or 6% Sevoflurane in 100% oxygen (6 L/min. FGF). The average time to the loss of the lid reflex was 62 seconds, occurring approximately 15 seconds after loss of consciousness. Out of 60 inductions, no subjects developed increased airway secretions or laryngospasm. The incidence of breath holding and/or mild coughing was less than 15%, and movement was not a significant event in any of the

subjects. In addition, these studies also determined the length of time needed to get optimal intubating conditions without the use of neuromuscular blocking agents. This goal was driven primarily by the potential to reduce costs by avoiding monopolarizing neuromuscular blocking drugs. After loss of consciousness, we assisted the ventilation to force a rapid deepening of anesthesia sufficient of laryngoscopy and endotracheal intubation or insertion of laryngeal mask airway (LMA) without the use of neuromuscular blocking drugs. We were able to achieve good intubating conditions in 4.5 minutes in the group receiving Sevoflurane and nitrous oxide/oxygen and in 6 minutes in the group received Sevoflurane and 100% oxygen. The cost of anesthetic agent(s) during this induction and through tracheal intubation was US\$ 6 to US\$ 8.00/case.

We are now conducting a study that employs small doses of fentanyl or midazolam as pretreatment prior to mask induction of anesthesia with Sevoflurane/nitrous oxide. Good intubing conditions are being achieved in only three minutes.

In summary, the technique of mask induction of anesthesia in adult patients with Sevoflurane has proven to be safe, rapid and cost-effective. Unlike the other available volatile agents, sevoflurane's non-irritating, non-pungent odor and low solubility allows a very rapid induction, approaching the induction time achieved with intravenous agents without the high

SUMMARY OF THE CONCENTRATION ADMINISTERED & INDUCTION TIME FROM RAPID INHALATIONAL INDUCTION STUDIES USING SEVOFLURANE IN ADULTS

Concentration Administered	Gas Mixtures	Induction Time in seconds \pm SD	Literature Citation
7.5%	N ₂ O/O ₂	41 \pm 16	2,3,4
7.5%	O ₂	47 \pm 17	1
7%	N ₂ O/O ₂	42 \pm 3	8
6%	O ₂	52 \pm 15	1
5%	N ₂ O/O ₂	75 \pm 3	5
4.5%	N ₂ O/O ₂	81 \pm 22	7,9
4.5%	N ₂ O/O ₂	55 \pm 10	7
3%	O ₂	120 \pm 24	6

incidence of untoward airway complications. This technique has some very desirable qualities in that the full attention of the anesthesiologist is on the airway. This contrasts to mixing drugs, measuring doses and injecting substances when the intravenous route is chosen for induction of anesthesia. Our current goal is to retrain the anesthesiologist in the art of inducing anesthesia via the face mask. There is another large advantage of the mask induction technique over the intravenous agent in controlling the airway. Most induction doses of intravenous drugs cause apnea. Patients do not resume spontaneous ventilation for approximately 5 minutes after an intravenous agent is given and, if incubation is unexpectedly not possible, hypoxia and organ damage can occur. If adequate intubating conditions are not present, a laryngeal mask airway can be inserted and spontaneous ventilation can continue with the volatile anesthetic.

This article was very kindly provided by Abbott Laboratories (Pakistan) Ltd, and is published as an educational service for the readers.

REFERENCES

1. M Yourino, H Kimura. Efficient Inspired Concentration of Sevoflurane for Vital Capacity Rapid Inhalation Induction (VCRII) Technique. J. Clin Anest Vol 7 May 1995: 228-231

2. M Yurino, H Kimura. Comparison of induction time and characteristics between sevoflurane and sevofluran/nitrous oxide. Acta Anaesthesiol Scand 1995:39:356-311
3. M Yurino, H Kimura. A Comparison of Vital Capacity Breath and Tidal Breathing Techniques for Induction of Anaesthesia with High Sevoflurane Concentration in Nitrous Oxide and Oxygen. Anaesthesia, Vol 50, Apr 1995: 308-311
4. M Yurino, H Kimura. Ultra Rapid Induction of Anesthesia with a High Concentration of Sevoflurane in Nitrous Oxide and Oxygen. Anesth Resus. 1994:30(1):69-71
5. MH Sloan, PF Conard, JB Gross. Sevoflurane Versus Isoflurane: Induction and Recovery Characteristics with Single-Breath Inhaled Inductions of Anesthesia. Anesth Analg 1996; 82:528-32
6. M Yurino, H Kimura. Vital Capacity Breath Technique for Rapid Anaesthetic Induction: Comparison of Sevoflurane and Isoflurane. Anaesthesia Nov 1992; 47(11):946-949
7. M Yurino, H Kimura. The Influence of Additional Nitrous Oxide during Rapid Anesthetic Induction with Sevoflurane. J Anesth (Japan) 1994; 8(4):406-409
8. H Fukada, H Kasuda, K Saitoh, et al. Rapid Induction of Anesthesia with Inhalation of Sevoflurane. Jpn J Anesth 1993; 42:1744-1747
9. M Yurino, H Kimura. Vital Capacity Rapid Inhalation Technique: Comparison of Sevoflurane and Halothane. Can J Anaesth. 1994;40(5 pt 1):440-443

New Products

APRANOX

Roche Laboratories has launched naproxen sodium under the brand name of 'Apranax' tablets. Available in 550 mg, it belongs to NASID group and is suitable for mild to moderate pains, dental pains, dysmenorrhoea as well as acute migraine attacks.

Contraindications pertain to that of any drug from NSAID group.

Marketed by: Roche Pakistan Ltd.

WILGESIC

It contains orphenadrine and paracetamol. The former drug blocking reticular facilitation, i.e. it blocks preferentially those pathways whose hypersensitivity leads to an exaggeration of motor function, such as spasticity, rigidity or muscle spasm.

Paracetamol has analgesic and antipyretic

properties. Wilgesic is available as tablets of 500 mg.

Marketed by: Wilson's Pharmaceuticals Islamabad

ESPOCAN

Combined spinal epidural needle set has been introduced by B.Braun. The pencil point spinal needle (Whitacre) is 15 mm, and 'Quincke' type needle is 13 mm protruded out of the back-eye of the Tuohy needle. The catheter is supplied in soft Tip version and may be of soft or standard stiffness.

Marketed by: B.Braun Pakistan Ltd.

FLUMAZENIL

The first ever antidote of benzodiazepines has been introduced in the local market by Roche. The product is useful in overdose or poisoning by diazepam and allied drugs.

Marketed by: Roche Pakistan Ltd.