A Devised Method for the Fiberoptic Nasotracheal Intubation under General Anesthesia

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Fiberoptic nasotracheal intubation (FNI) has been used for facilitation of difficult tracheal intubations[1,2]. Generally, because of a compromised airway, the procedure has been performed in awake patients using sedatives and topical anesthesia[3]. However, this is occasionally an unpleasant experience for the patient[4]. Therefore, it is preferable that the FNI is performed under general anesthesia. Recently, there have been a few reports on fiberoptic orotracheal intubation under general anesthesia with intermitted positive pressure ventilation (IPPV) using a specialized mask or an airway intubator[5,6]. However, no technique has been developed to perform the FNI under general anesthesia with IPPV.

Here, we introduce a method for the FNI under general anesthesia with IPPV. The validity of this method is also reported.

Patients and Methods

Seven male and 17 female adult patients undergoing elective surgery under general anesthesia were indicated. In 8 of these patients, tracheal intubation by direct laryngoscopy was considered to be difficult; four had ankylosis of the temporomandibular joint, and four were in "halo" traction. In remaining the 16 patients, routine tracheal intubation was not considered to be difficult, but nasotracheal intubation was required for maxilofacial surgery. The patients were 33.4 ± 16.1 (mean + SD) years old, weighed 53.9 ± 5.4 kg and were 159.2 ± 6.3 cm tall. They had neither cardiac nor pulmonary disease. The study protocol was approved by the Ethical Committee of the Medical Faculty, Kyoto University. Informed consent was obtained from each patient.

All patients were premedicated with 10 mg diazepam given orally 1 hr before induction of anesthesia, and with 0.5 mg atropine given intramuscularly 30 min before induction. In the operating room an intravenous infusion was started and an ECG (lead II) was attached. The radial artery was cannulated under local anesthesia for continuous blood pressure (BP) monitoring and blood sampling. After the patients' BP and heart rate (HR) had stabilized, a set of data (blood gases, BP and HR) was recorded as the values in awake stage (stage 0). Following the confirmation of a free airway with manual ventilation using mask, the patients were given 5 $mg \cdot kg^{-1}$ i.v. of thiopental and 0.1 $mg \cdot kg^{-1}$ i.v. of vecuronium and the lungs were ventilated with 1.5% enflurane and 50% nitrous oxide in oxygen. About 5 min later, the first set of data after induction of anesthesia was recorded (stage I). Then, ventilation was stopped and the patient was inserted with a Portex endotra-

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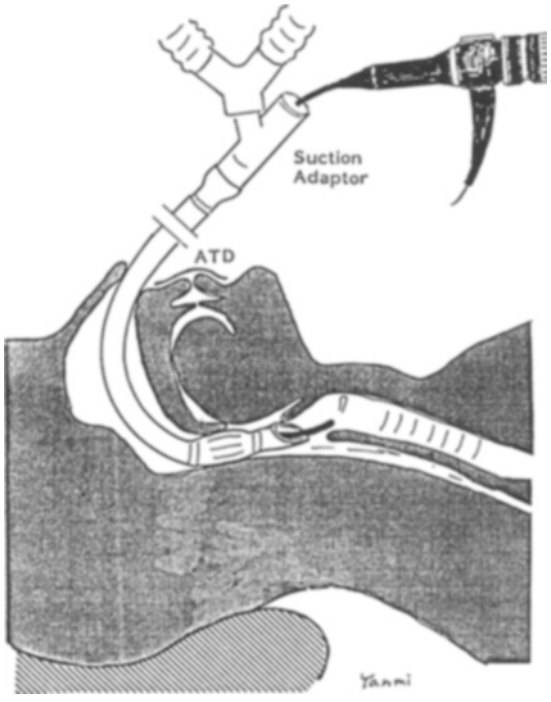

Fig. 1. Schematic of fiberoptic nasotracheal intubation under general anesthesia with IPPV.
A patient's mouth and nose are sealed with an adhesive transparent dressing (ATD).
A fiberscope is inserted through the valve of a suction adaptor into oropharynx.

cheal tube (internal diameter [ID] 7.5 mm or 8.0 mm), previously immersed in warm water for increased flexibility and generously lubicated with lidocaine jelly, through the selected nostril into the oropharynx. Following the insertion of the endotracheal tube, the patient's mouth and the open side of nostril were sealed closely with an adhesive transparent dressing (Ensure-it, Desert Medical Inc., Salt Lake City, UT), and a suction adapter (Suction Safe, Sontek Medical Inc., Dallas, TX) was interposed between the proximal end of the endotracheal tube and the ventilatory circuit (fig. 1). Manual ventilation was resumed through the endotracheal tube as a nasal airway. About 5 min later, the second set of data was recorded (stage II). Then, an Olympus LF-1 fiberoptic intubating laryngoscope (outer diameter [OD] 4.0 mm) was inserted through the valve of the suction adaptor into the oropharynx for the exploration of the vocal cords. During the exploration, if necessary, the removal of secretions or blood was performed through the suction channel of the fiberscope (1.2 mm), while manual ventilation was continued. Total gas flow was adjusted according to the extent of suction. After indentifying the vocal cords, the fiberscope was advanced into the trachea. Then, the endotracheal tube was threaded over the fiberscope into the trachea, followed by the collection of a third set of data (stage III). In this stage, the required time for intubation (from oropharyngeal insertion of fiberscope to completion of intubation) was recorded. About 5 min later, the last set of data was recorded (stage IV), and then surgery was started. The anesthesiolosist interviewed each patient regarding his or her anesthetic experience on the next day after surgery.

Data were expressed as mean ± SD. Data in awake stage (stage 0) were not included in the analysis. The changes in blood gases, mean BP and HR in the anesthetized stages (stage I to IV) were analyzed by the Friedman statistics followed by the Wilcoxon signed-rank test with the Bonferroni correction. $P < 0.05$ was considered significant.

Results

Blood gases (Pa_{O_2} and Pa_{CO_2}), mean BP and HR at different stages during the FNI are summarized in table 1. Compared with the baseline values of Pa_{O_2} during the IPPV with mask (stage I), those in the following stages decreased slightly but significantly. However, even during these stages, the values of Pa_{O_2} were maintained at a high level, and the lowest value in all instances was 213 torr. Pa_{CO_2} did not show any significant changes in any stage after induction. Mean BP increased significantly in stage III, when the trachea was intubated. Although there were no significant changes, HR also tended to increase in this stage. The required time for intubation was 312 ± 203 sec. The longest time registered was 970 sec. In this patient, it was difficult to identify the vocal cords because of secretions. However, even in this

Table 1. The changes in blood gases (Pa_{O_2} and Pa_{CO_2}), mean blood pressure (Mean BP), and heart rate (HR) at different stages during fiberoptic nasotracheal intubation

Stage	0	I	II	III	IV
Pa_{O_2} (torr)	95 ± 12	326 ± 36	301 ± 34*	297 ± 32*	282 ± 35**
Pa_{CO_2} (torr)	40 ± 2	35 ± 4	35 ± 6	35 ± 5	35 ± 5
Mean BP (mmHg)	97 ± 10	84 ± 10	85 ± 13	115 ± 16**	87 ± 14
HR (beat/min)	86 ± 15	103 ± 18	103 ± 16	111 ± 12	96 ± 13

Stages: 0, awake; I, during IPPV with mask (baseline); II, during IPPV through nasal tube; III, immediately following intubation of trachea; IV, 5 min after intbation. Data are shown as mean ± SD with n=24. * and **: $P < 0.05$ and $P < 0.01$, respectively, compared with baseline value (state I).

patient, appropriate ventilation and oxygenation were maintained during the procedure (251 torr Pa_{O_2} and 38 torr in Pa_{CO_2}).

In some patients, rotation of the endotracheal tube over the fiberscope was needed in order to be able to intubate the trachea, but there were no cases in which the endotracheal tube could not be advanced into trachea. There was no complications associated with the FNI, and no patient recalled any part of the intubation procedure in postoperative interviews.

Discussion

The most important thing in the FNI of anesthetized patients is to keep the airway free and to maintain adequate ventilation and oxygenation. In our method, the airway was ensured successfully by using an endotracheal tube as a nasal airway. The absence of CO_2 retention indicates that adequate ventilation was maintained even when the endotracheal tube was narrowed by an inserted fiberscope. This is probably due to the proper ratio between the ID of the endotracheal tube (7.5 mm or 8.0 mm) and the OD of the fiberscope (4 mm)[7]. On the contrary, slight but progressive decrease in Pa_{O_2} were observed during the procedure. Since the decrease in Pa_{O_2} was noticed even after intubation (stage IV), microatelectasis in the lungs might have occurred during the procedure of FNI in some cases in which vigorous suctioning was needed for the exploration of the vocal cords. Therefore, intentional hyperinflation of the lung, which is recommended after endotracheal suctioning[8], might be beneficial in the case of FNI. The increase in mean BP and HR during intubation of the trachea (stage III), which is reported also in the procedure of FNI performed under topical anesthesia and sedation[4], might have been avoided if another anesthetic technique such as low-dose fentanyl anesthesia was chosen[9].

The FNI under general anesthesia introduces a special problem; the pharyngeal collapse which leaves little or no air space to see through. Because of this problem, intubation with a fiberscope in anesthetized patients is thought to be more difficult than in those who are awake[10,11]. This problem may be overcome by pulling forward on the tongue with a forceps or by using a specialized retractor[12,13], but these methods are not possible when the IPPV is performed. In our method, although this problem is not overcome, the maintenance of adequate pulmonary gas exchange even in the case which needs a lot of time for intubation compensates this problem. Moreover, in our method, the use of a muscle relaxtant allowes for good exposure of the vocal cords. Further, laryngospasm is completely avoided without translaryngeal injection of lidocaine[3].

There are some reports about the difficulty in placement of an endotracheal tube after the insertion of a fiberscope into trachea[14]. In our study, this problem was overcome simply by rotating the tube over

the fiberscope. This may be attributed to the use of a stiffer device (Olympus LF-1) recommended for intubation procedure[15].

In conclusion, the FNI under general anesthesia with IPPV (including the use of a muscle relaxant) provides adequate pulmonary gas exchange during the procedure, avoids laryngospasm, and is not unpleasant to the patients.

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References

1. Merphy P: A fiberoptic endoscope used for nasal intubation. Anaesthesia 22:489–491, 1967
2. Messeter KH, Pettersson KI: Endotracheal intubation with the fiber-optic bronchoscope. Anaesthesia 35:294–298, 1980
3. Ovassapian A, Yelich SJ, Dykes MHM, Brunner EE: Fiberoptic nasotracheal intubation – incidence and causes of failure. Anesth Analg 62:692–695, 1983
4. Ovassapian A, Yelich SJ, Dykes KHK, Brunner EE: Blood pressure and heart rate changes during awake fiberoptic nasotracheal intubation. Anesth Analg 62:951–954, 1983
5. Rogers SN, Benumof JL: New and easy techniques for fiberoptic endoscopy-aided tracheal intubation. Anesthesiology 59:569–572, 1983
6. Williams RT: Fiberoptic assisted tracheal intubation under general anesthesia with IPPV. Anesthesiology 66:853, 1987
7. Lindholm C-E, Ollman B, Snyder JV, Millen EG, Grenvik A: Cardiorespiratory effects of flexible fiberoptic bronchoscopy in critically ill patients. Chest 74:362–368, 1978
8. Goodnough SKC: The effects of oxygen and hyperinflation on arterial oxygen tention after endotracheal suctioning. Heart Lung 14:11–17, 1985
9. Martin DE, Rosenberg H, Aukburg SJ, Bartkowski RR, Edwards MW Jr, Greenhow DE, Klineberg PL al: Low-dose fentanyl blunts circulatory responses to tracheal intubation. Anesth Analg 61:680–684, 1982
10. Edens ET, Sia RL: Flexible fiberoptic endoscopy in difficult intubations. Ann Otol 90:307–309, 1981
11. Sia RL, Edens ET: How to avoid problems when using the fiber-optic bronchoscope for difficult intubations. Anaesthesia 36:74–75, 1981
12. Lloyd EL: Fiberoptic laryngoscopy for difficult intubation. Anaesthesi 35:719, 1980
13. Childres WF: New method for fiberoptic endotracheal intubation of anesthetized patients. Anesthesiology 55:595–596, 1981
14. Moorthy SS, Dierdorf SF: An unusual difficulty in fiberoptic intubation. Anesthesiology 63:229, 1985
15. Green CG: Improved technique for fiberoptic intubation. Anesthesiology 64:835, 1986