

The patency of the airway via each upper airway orifice during general anesthesia

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Abstract: The patency of the airway via each orifice was examined during general anesthesia in 112 patients by occluding other orifices in order to develop a method in which fiberoptic endotracheal intubation (FEI) and ventilation could be performed via different orifices. Ventilation was well maintained via the mouth in 61 (54.5%), via bilateral nostrils in 87 (77.7%), and via the unilateral right and left nostril in 67 (59.8%) and 73 (65.2%) patients, respectively. With the aid of an artificial airway, ventilation was well maintained via the mouth in 112 (100.0%), via bilateral nostrils in 111 (99.1%), and via the unilateral right and left nostril in 106 (94.6%) and 105 (93.8%) patients, respectively. Based on these findings, we developed a method in which FEI is performed via the nostril, while ventilation is performed with a mask applied over only the mouth.

Key words: Airway, Mouth, Nostril, General anesthesia

Introduction

Fiberoptic endotracheal intubation (FEI) is a very useful method for difficult intubation. FEI is usually performed while the patient is awake [1–6]. However, under certain circumstances it must be utilized during general anesthesia, e.g., when difficult endotracheal intubation is recognized after induction or when the patient refuses or cannot tolerate awake intubation. Several types of face masks incorporating a diaphragm, through which a fiberscope and an endotracheal (ET) tube are inserted, have been designed for this purpose [7–9]. These masks make it possible to maintain ventilation and anesthesia during FEI. However, none are wholly satisfactory because the mask and diaphragm

reduce the maneuverability of the fiberscope and the ET tube [10].

We speculated that FEI would be performed safely and easily under general anesthesia if ventilation and FEI could be performed separately via different airway orifices, e.g., the nostril or mouth. So we examined the patency of the airway via each orifice during general anesthesia to develop a method in which ventilation and FEI could be performed via different airway orifices.

Materials and methods

We studied 112 adult patients with ASA physical status 1 or 2 scheduled to undergo general anesthesia. Patients with orofacial or upper airway disease were excluded. Informed consent was obtained from each patient preoperatively. The patients were supine with the head in a neutral position, 3–4 cm above the plane of the table by using a pillow. Anesthesia was induced with intravenous thiamylal (1–2 mg/kg) or midazolam (3–5 mg), nitrous oxide, oxygen, and enflurane or isoflurane. Five minutes after administration of vecuronium (0.1 mg/kg), the anesthesiologist evaluated whether or not ventilation was well maintained by assessing the chest movement and the airway resistance under each of the following conditions: step 1, ventilation via the mouth with bilateral nostrils occluded by cotton plugs; step 2, ventilation via bilateral nostrils with the mouth occluded by adhesive tape; step 3, ventilation via the right nostril with the mouth and left nostril occluded; and step 4, ventilation via the left nostril with the mouth and right nostril occluded. At each step, 5 to 7 breaths were applied manually with a standard anesthesia mask. Extension of the neck and/or protrusion of the mandible was performed at each step if necessary. In cases of insufficient ventilation, the state of ventilation was re-evaluated after an oropharyngeal airway (No. 3 or 4 Guedel airway, Portex) or a naso-

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pharyngeal airway (6.0 or 7.0 mm nasopharyngeal airway, Portex) was inserted into the examined orifice.

Results

Ventilation was well maintained without occluding any orifices in 106 (95.6%) of the 112 patients, via the mouth in 61 (54.5%), via bilateral nostrils in 87 (77.7%), and via the right and left nostril in 67 (59.8%) and 73 (65.2%), respectively. With the aid of an artificial airway, ventilation was well maintained via the mouth in 112 patients (100.0%), via bilateral nostrils in 111 (99.1%), and via the right and left nostril in 106 (94.6%) and 105 (93.8%), respectively. The nasopharyngeal airway could not be inserted due to narrowness or occlusion of the nostril in 12 of 13 nostrils through which ventilation was not maintained. In all 112 patients, endotracheal intubation was performed without difficulty.

Discussion

There are no reports to our knowledge regarding the patency of the airway via each orifice during general anesthesia. Our study revealed that, with the aid of an artificial airway, the patency of the airway via the mouth and via bilateral nostrils is sufficient to maintain ventilation in almost all patients.

General anesthesia causes obstruction of the pharyngeal airway: The soft palate falls against the posterior pharyngeal wall, occluding the nasopharynx [11], and the tongue and epiglottis move posteriorly, occluding the oral or hypopharyngeal airway [12,13]. These changes were presumably the main causes of difficulty in ventilation via each orifice. This study showed that the airway via only the mouth becomes patent enough to maintain ventilation with the use of an oropharyngeal airway in all or almost all patients, and that ventilation via only the nostril is difficult in some patients because of the narrowness or occlusion of the nostril, although the airway via either of the two nostrils is patent enough to maintain ventilation with the use of a nasopharyngeal airway in almost all patients.

The present findings suggested that passage via the mouth or via the bilateral nostrils is a competent ventilation route when the other route is used for FEI. Therefore, we developed a method in which FEI is performed via the nostril, while ventilation is performed with a mask applied over only the mouth (mouth mask)

[14]. We selected the mouth as the ventilation route and the unilateral nostril as the FEI route because FEI is performed more easily via the nostril than via the mouth [3–5], and because the air leakage from the contralateral nostril during FEI is more easily prevented than that from the mouth. Using this method, we performed FEI in 41 patients with difficulty in intubation over a period of 3 years. Ventilation with the mouth mask was successful in 40 patients and unsuccessful in 1 patient. These findings showed that ventilation can be sufficiently maintained via only the mouth in almost all patients with difficult intubation.

In summary, we confirmed that ventilation via the mouth or via bilateral nostrils can be maintained in almost all patients with the aid of an artificial airway, and developed a method of FEI under general anesthesia in which FEI is performed via the nostril while ventilation is performed with a mask applied over only the mouth.

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