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Preoxygenation With Tube-Tip-in-Mouth Method: A Case Report of a Feasible Alternative for a Patient With Claustrophobia Who Could Not Tolerate the Face Mask

Authors' Contribution:
Study Design A
Data Collection B
Statistical Analysis C
Data Interpretation D
Manuscript Preparation E
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Funds Collection G

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Patient: Female, 52-year-old
Final Diagnosis: Claustrophobia
Symptoms: Anxiousness
Clinical Procedure: —
Specialty: Anesthesiology
Objective: Unusual setting of medical care
Background: Preoxygenation prior to induction of general anesthesia is recommended to prolong the safe apnea time and avoid hypoxia during airway management, but conventional preoxygenation using a tight-fitting face mask can cause discomfort and be poorly tolerated by some patients, especially those experiencing claustrophobia or anxiety. Alternative techniques, such as high-flow nasal oxygen, require additional equipment and do not allow reliable monitoring of end-tidal oxygen levels. This case report seeks to offer an equipment-free alternative preoxygenation method for a patient in this subgroup.
Case Report: A 44-year-old woman was scheduled for elective unilateral parotidectomy. In the operating room, she presented with significant anxiety and claustrophobia related to face mask ventilation. Her airway assessment was unremarkable, and she had no comorbidities. After unsuccessful attempts to improve tolerance to mask preoxygenation, she underwent successful preoxygenation using an alternative method. The patient breathed through the tip of an endotracheal tube connected to the anesthesia circuit, holding the tube herself while guided to inhale and exhale. An expiratory oxygen fraction of 80% was achieved within 2 minutes, allowing induction of anesthesia. No desaturation occurred during induction or airway management. The same tube was subsequently used for tracheal intubation. Postoperatively, the patient reported feeling more comfortable and in control compared with previous experiences.
Conclusions: Using tube-tip-in-mouth preoxygenation we found a very simple, equipment-free method that offered a feasible alternative for this patient who was intolerant to conventional mask preoxygenation. End tidal oxygen levels could still be measured before induction of general anesthesia. We believe that this technique could be considered an option for future patients.
Keywords: Anesthesia, Endotracheal • Claustrophobia • Communication • Humans • Intubation • Resource-Limited Settings
Full-text PDF: <https://www.amjcaserep.com/abstract/index/idArt/953611>

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Introduction

It is recommended to pre-oxygenate patients before induction of general anesthesia [1] to achieve a longer, safe apnea period while securing the airway [2]. Preoxygenation is traditionally done using the circle breathing circuit with a tight-fitting ventilation mask sealing the mouth and nose. In this case report, we describe an alternative method of preoxygenation called “tube-tip-in-mouth” (TTIM) that may be a feasible pre-oxygenation option in selected cooperative adult patients who cannot tolerate a face mask. The feasibility of the technique was assessed by achieving adequate capnography-confirmed ventilation, a targeted expiratory oxygen fraction before induction, and patient satisfaction with the method.

Some patients may find preoxygenation claustrophobic [3] and experience the process, including general anesthesia, as a loss of control. Good communication skills and anxiolytic medication may increase compliance and enable preoxygenation despite claustrophobia or the feeling of losing control; however, this approach must be planned otherwise it can cause a delay in the schedule. Additionally, there is a risk of adverse effects, including discomfort or a hangover effect.

Alternatives, such as preoxygenation using a high-flow nasal cannula system [4], have been described and are perceived as acceptable to some patients [5]. However, high-flow systems require additional equipment, are costly, and may not be readily available in the operating room. Additionally, it is not possible to measure end-tidal O_2 concentrations when patients are not exhaling into the circle system.

The patient in this report provided informed written consent for publication of this case.

Case Report

A 44-year-old woman was scheduled for unilateral parotidectomy at the ear, nose, and throat surgical department because of a possible malign process in her gland. She was not on any medication and had a height of 174 cm and a weight of 70 kg, for a body mass index (kg/m^2) of 23. She had an airway assessment with a Mallampati score of II, mouth opening greater than 4 cm, normal jaw protrusion, neck mobility with normal flexion and extension greater than 90 degrees, thyro-mental distance greater than 6 cm, and good dental status. We were able to palpate the cricothyroid membrane.

The patient was monitored via a Phillips Intellivue monitor, which showed a normal noninvasive blood pressure reading, 3-lead electrocardiography with sinus rhythm, and oxygen saturation of 100% before preoxygenation. In the operating



Figure 1. Photographic example with staged assistance of the tube-tip-in-mouth method of preoxygenation, in which the patient holds the tube herself. Akin to breathing through a straw, she is focusing on emptying and blowing up the ventilation bag and thereby breathing through the mouth into the ventilation system.

room, she clearly expressed that she was anxious and had previously had bad experiences undergoing general anesthesia. Specifically, she felt claustrophobic when breathing through the ventilation mask. We tried to calm the patient by talking with her and offered her the option to hold the ventilation mask herself, but she still felt uncomfortable. Subsequently, we altered to the TTIM method with the aim of preoxygenating the patient until end tidal oxygen (ETO_2) was 80% or higher to avoid desaturation, to ensure adequate confirmed pre-oxygenation before induction, and to obtain patient satisfaction. We connected the endotracheal tube to the circle circuit, asked the patient to hold the tube in one hand and offered the patient to place the tip of the endotracheal tube in her mouth, close the mouth, and breathe through the tube (Figure 1). We successfully managed to preoxygenate the patient comfortably by guiding her to take deep breaths akin to suctioning via a straw, thus breathing solely via the tube. Through the entire preoxygenation, the oxygen saturation was 99% to 100%.

We used a Dräger Primus ventilator and preoxygenated the patient with 100% oxygen at a flow of 18 L/min in manual mode with the adjustable pressure limiting valve at 0 cm H_2O . The patient was preoxygenated through an endotracheal tube (size 7.0) using the TTIM method described above. By asking the patient to focus on emptying the ventilation balloon, she automatically breathed via the mouth and not via the nose. Adequate ventilation (end-tidal CO_2 of 4.5-5.5 kPa) was confirmed by capnography. The patient obtained a minute volume of 4.5 L and reached an expiratory oxygen fraction of 80% within 2 minutes. Maximal expiratory oxygen fraction was 86%. We considered 80% an acceptable expiratory oxygen fraction

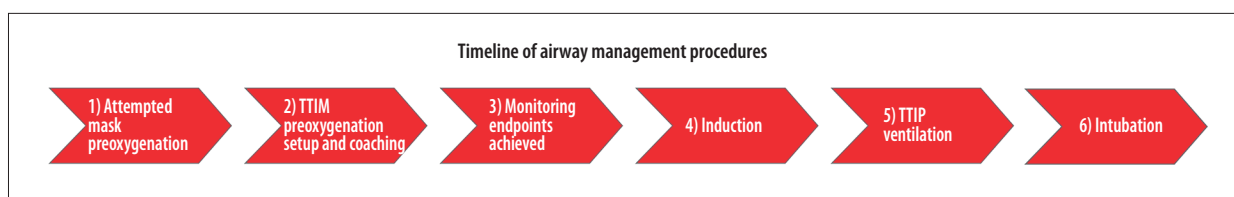


Figure 2. Timeline showing the different steps in airway management procedure of the patient from preoxygenation attempt with a face mask to endotracheal intubation.

in this patient with no anticipated difficult airway, previous easy mask ventilation and intubation, no indication for rapid sequence induction, and normal lung function.

After changing the method of preoxygenation from face mask ventilation to TTIM, the patient's pupils decreased from approximately 6 mm bilaterally to 4 mm measured by visual estimate, which may be imprecise. Additionally, the heart rate decreased from approximately 100 beats/min to 80 beats/min.

General anesthesia was then induced intravenously with propofol 2.5 mg/kg (bolus) and remifentanyl 4 µg/kg injected over a 90-second period, which is standard procedure in our department, to ensure satisfactory anesthesia and conditions for intubation without the use of nerve blocking agents, which was to be avoided due to the type of surgery. No chest wall rigidity was observed when delivering the opioid over a 90-second period. During induction, we manually supported the endotracheal tube and ventilation system to avoid the risk of it dropping when the patient went under general anesthesia. Infusion pumps were started, and the patient was ventilated with tube tip in pharynx (TTIP) ventilation [6,7] using the same endotracheal tube. After 2 minutes of TTIP ventilation, and after we had confirmed that the patient was sufficiently anesthetized, the patient was intubated in the trachea, and the ventilator was set to controlled ventilation mode with a respiratory rate of 12, tidal volume of 460 mL, and peak end expiratory pressure of 5 cm H₂O. Oxygen saturation was 100% and did not change during induction, TTIP ventilation, or induction. We did not experience any difficulty during preoxygenation, induction, or maintenance of the anesthesia (Figure 2).

On postoperative day 1, the patient was interviewed regarding the method of preoxygenation. She stated that it was more comfortable breathing through the tube and less claustrophobic than with the ventilation mask. She said she would prefer the TTIM method over the face mask if she were to undergo general anesthesia again. This was an unstructured open interview asking the patients opinion and is not validated for general use.

Discussion

To our knowledge, the TTIM method has not previously been described in the literature. A method using a mouthpiece and a

nose clip has been described [8], but excess equipment comes with a cost and a carbon footprint, whereas the TTIM method has the advantage of not using excess equipment and still allowing measurement of ETO₂ during preoxygenation. The novelty of the TTIM method is the possibility of preoxygenating a patient who cannot tolerate the face mask, without using any additional equipment, such as a mouthpiece, and still being able to measure end-tidal O₂ and end-tidal CO₂, thus achieving preoxygenation goals by instructing the patient to breathe via the tube when holding it with her or his hand.

We considered TTIM a viable alternative to conventional face mask preoxygenation because it achieved normal end-tidal CO₂ and an expiratory oxygen concentration greater than 80% before induction. After induction, the TTIM preoxygenation allowed us to immediately transfer to TTIP and ventilate the patient with the same endotracheal tube as used for preoxygenation. Since the publication by Markham et al [9], we have considered TTIP an equal alternative to mask ventilation. In the present case, in which we already had employed the tube for the preoxygenation, it was natural to just continue to TTIP ventilation upon induction of anesthesia, instead of switching to mask ventilation. An additional benefit was that, in this way, we did not need to use a facemask at all for the whole conduct of the anesthesia.

Since we used the same endotracheal tube for preoxygenation and for the subsequent tracheal intubation, this method did not require additional equipment, and it can be reproduced in any operating room. The method required some patient guidance to ensure ventilation occurred through the endotracheal tube and not through the nose. By instructing the patient to imagine that she was breathing via a straw and by telling her to empty the ventilation bag, she automatically breathed via the mouth and not via the nose. This technique comes with some limitations and may not be suitable for all patients. The patient in this case was compliant and able to follow our instructions, only breathing through the tube and not biting it or damaging the cuff, which could be a potential risk. Since the patient was holding the tube subsequently used for intubation, there was a theoretical risk of infection. This patient was able to obtain a satisfactory end expiratory O₂ fraction by breathing through the 7-mm tube without breath support, but that may not be the case for patients with reduced respiratory

reserve. Previous studies have found it easier to preoxygenate patients using a nose clip during alternative methods [8], but that may cause more patient discomfort. In children, familiarizing patients with the face mask before anesthesia has been shown to decrease anxiety and increase compliance [10]. It is therefore plausible that handing the tube to the patient will have the same effect and will help them feel in control.

Preoxygenation difficulties reaching a satisfactory ETO_2 with a regular face mask is a common problem and is more common with risk factors for difficult mask ventilation [11]. Although not tested in this case, we hypothesize that the present technique might be an alternative approach in other cases of insufficient preoxygenation due to low mask tolerance, beard, lack of teeth, or other alterations in the shape of the face complicating face mask preoxygenation, given that the patient is compliant and can successfully breathe through the mouth only. By instructing the patient in our case to focus on blowing up and emptying the visualized ventilation bag of the circle system, we did not encounter any issues achieving a satisfactory end-expiratory oxygen fraction. A recent paper [12] reviews existing literature on alternative preoxygenation and describes a snorkel technique using a catheter mount, or simply the anesthesia hose, as a mouthpiece. The authors suggest that it has several applications: preoxygenation, rapid sequence induction, apneic oxygenation, patient phobia to face masks, and smoother pediatric gas induction. This review is based on case reports and small comparative studies and cannot draw conclusions on safety nor efficiency for this current technique.

In future studies, it would be interesting to investigate the feasibility of TTIM in a larger group of patients, whether this preoxygenation method is more time-consuming than conventional face mask preoxygenation to a clinically relevant degree, and whether patients prefer TTIM over face mask in terms of comfort. There have been no comparative studies regarding the comfort or safety between TTIM and mouthpiece or facemask preoxygenation.

Conclusions

For this patient who could not tolerate face mask preoxygenation, the TTIM method was a feasible alternative. By guiding the patient to fill and empty the ventilation balloon, we avoided nasal breathing, could easily obtain a satisfactory capnography curve and an end expiratory CO_2 in a normal range (4.5-5.5 kPa), and obtained ETO_2 greater than 80% without the use of additional equipment. The patient felt less anxiety in relation to anesthesia and preoxygenation compared with using the face mask. We hypothesize that the TTIM preoxygenation method could be beneficial in other scenarios, such as when there are difficulties obtaining a tight-fitting face mask; however, that has not yet been tested.

Department and Institution Where Work Was Done

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Informed Consent

The patient described in this case report has given written informed consent for publication of the case.

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Declaration of Figures' Authenticity

All figures submitted have been created by the authors who confirm that the images are original with no duplication and have not been previously published in whole or in part.

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