

Case Report

Tube tip in pharynx (TTIP) ventilation: Simple establishment of ventilation in case of failed mask ventilation

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Background: Mask ventilation occasionally fails. Alternative readily available and simple methods to establish ventilation in these cases are needed.

Methods: Retrospective description of cases in which a new technique, tube tip in pharynx (TTIP) ventilation, was employed for restoring ventilation in case of failed facemask ventilation during induction of anaesthesia. The technique involves a standard endotracheal tube and can be performed single-handed: A standard endotracheal tube was placed via the mouth with the tip in the pharynx and the cuff was inflated. By placing the fourth and fifth fingers below the ramus of the mandible, the third finger below the lower lip, the second finger above the upper lip and on one side of the nose and the first finger on the other side of the nose, an open airway is restored. Chin lift is inherent in the grip, thus contributing to opening of the airway.

Results: In all four cases of failed mask ventilation the anaesthetist could establish an open airway and subsequent

ventilation without the need for an assistant. There were no indications of gastric insufflation.

Conclusion: The TTIP technique established ventilation in all four patients after abandoned facemask ventilation. The technique only involves one person and an endotracheal tube and warrants to be included in the armamentarium of anaesthetists.

Further prospective studies are needed to refine the technique and delimit its indications.

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MASK ventilation occasionally fails (1) or is difficult to obtain (2). In these cases oropharyngeal or nasopharyngeal airways and two-person mask ventilation can be applied. In case of persistent insufficient mask ventilation a laryngeal mask airway or other supraglottic ventilatory devices can be employed (3, 4). However, these devices are not always available (5) or may fail.

An endotracheal tube with the tip in the oropharynx can be used as a simple, yet effective ventilatory device (6). A method for using the endotracheal tube in this way was described in a case presentation by Boyce (7) who used a two-hand technique necessitating a second person in order to ventilate the patient. We describe a one-hand technique that allows the anaesthetist to establish a patent airway and ventilate the patient at the same time using only a standard endotracheal tube with the tube tip placed in pharynx. Cases are presented where this technique has proved to be successful in case of failed mask ventilation.

Methods

We retrospectively examined anaesthesia records where bag and mask ventilation had failed for the period between June 2002 and March 2004. All cases where tube tip in pharynx (TTIP) ventilation was applied for this condition are described in the results.

Failed mask ventilation was defined as a clinical state where standard mask ventilation did not result in any movement of the thorax or any capnography curve and where the subsequent application of an oropharyngeal airway and two-person mask ventilation still did not result in clinically sufficient movement of the thorax. At this state it was judged that hypoventilation and desaturation would occur if no additional intervention was made. We did not wait for desaturation to occur. Description of the technique:

- A Upon induction of general anaesthesia with the patient lying supine with the head extended, the mandible is pulled upward and forward with the thumb of one hand thus opening the mouth



Fig. 1. Mandible is pulled upward and forward with the thumb of one hand (one-handed jaw thrust).

and retracting the tongue from the posterior pharyngeal wall (one-handed jaw thrust) (Fig. 1).

- B** The endotracheal tube, mounted with a 20-ml air-filled syringe for cuff inflation, is gently inserted 10–14 cm, dependent on patient size, or until any resistance is felt, in caudal direction by letting the tip of the tube follow the palate and the posterior pharyngeal wall (in order to place the tip of the tube posterior to the epiglottis). Care is taken not to use force or work against any resistance. The cuff is inflated with 20 ml of air (Fig. 2) and the jaw thrust is released.
- C** The left (or right) hand is now placed so that the fourth and fifth fingers are located caudally to the mandible allowing chin lift. The third finger is

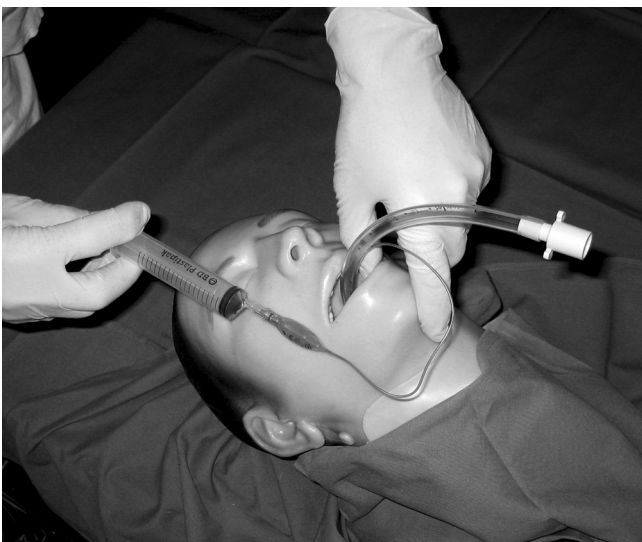


Fig. 2. Endotracheal tube is gently inserted in caudal direction and the cuff is inflated with 20 ml of air.

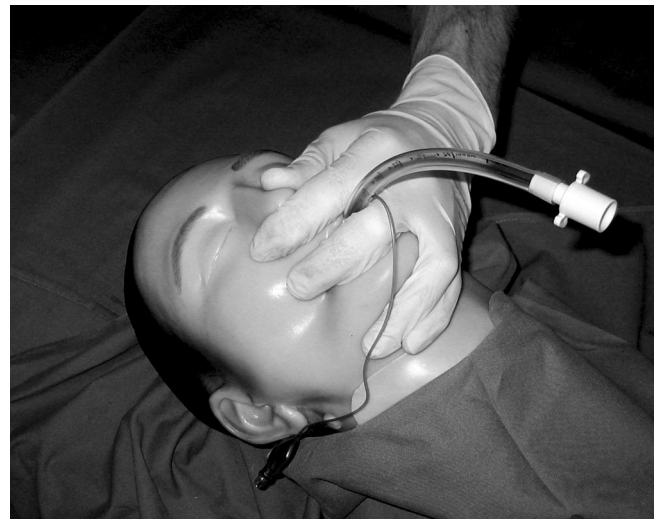


Fig. 3. Fourth and fifth fingers support the mandible allowing chin lift and the third finger is placed caudally to the lower lip contributing to efficient closure of the mouth. The first and second fingers are placed on each side of the nose allowing closure of the nose.

placed caudally to the lower lip contributing to efficient closure of the mouth and support of the tube. The second finger is placed cranially to the upper lip with the tip on one side of the nose whereas the first finger is placed on the opposite side of the nose thus allowing closure of the nose (Fig. 3).

- D** Ventilation can now be performed by connecting the standard breathing circuit, or a self-inflating (AMBU-) bag, to the tube (Fig. 4).

An alternative to step C is to place the hand with the palm and fifth finger facing the caudal part of the tip of the chin and the mandible while the first finger



Fig. 4. Tube tip in pharynx ventilation performed by connecting a standard breathing circuit to the tube. The patient has a body mass index of 46 and facemask ventilation was impossible.



Fig. 5. Alternative way of placing the fingers for tube tip in pharynx ventilation: the hand is placed with the palm facing the caudal part of the tip of the chin while the first two fingers support the tube and occlude the nose from each side.

supports the tube and occludes the nose from one side, and the second finger supports the tube and occludes the nose from the opposite side allowing simultaneous chin lift and inherent closure of the mouth (Fig. 5).

A model presentation of the relation of the tube-tip, cuff, epiglottis and base of the tongue is seen in Fig. 6. Upon establishment of TTIP ventilation and following muscle relaxation, laryngoscopy can be performed with the tube in place after emptying the cuff. Thereafter the tube can be advanced to the trachea.

Institutional board approval for the study was not sought because according to local orders it is not needed for case presentations.

Results

In four cases TTIP ventilation was employed in case of failed, or insufficient, mask ventilation. In all cases anaesthesia was induced with propofol (bolus and infusion) and remifentanyl infusion and all patients were preoxygenated with at least four deep breaths of oxygen as part of our standard procedure. Mask ventilation was initiated when a clinically sufficient level of anaesthesia (including disappearance of the eye-lash reflex) was reached.

Presentation of cases

Demographic data, preoperative evaluation including Mallampati class (8) and data on the TTIP ventilation are presented in Table 1.



Fig. 6. Relation of the tube-tip, cuff, epiglottis and the base of the tongue in tube tip in pharynx ventilation.

Case 1

Patient scheduled for operation on the nasal septum.

The patient had no previous anaesthesia history and had a full dentition.

Upon failure of mask ventilation an endotracheal tube (Portex Profile soft-seal cuff clear oral/nasal Murphy eye) was placed blindly into the oropharynx as a TTIP. The ventilation was now easy with normal excursion of the thorax and normal waveform of the capnography curve. Subsequent intubation was uneventful.

Case 2

Patient scheduled for anaesthesia due to suspicion of a relapse of lingual cancer for which he was operated and had radiation therapy 4 years before.

Previous anaesthesia 4 years earlier was uneventful.

The patient had no upper teeth and had a partial prosthesis in the lower jaw. After failure of mask ventilation an endotracheal tube (Portex Profile soft-seal cuff clear oral/nasal Murphy eye) was placed in the oropharynx as a TTIP. The ventilation was now easy with normal excursion of the thorax and normal waveform of the capnography curve. Subsequent intubation was uneventful.

Case 3

Patient scheduled for anaesthesia for direct laryngoscopy by an otorhinolaryngologist due to suspicion of recurrence of laryngeal cancer.

Preoperative fiberoptic laryngoscopy by the otorhinolaryngologist had revealed a broadened right vocal cord.

Tube tip in pharynx ventilation was applied after failure of mask ventilation and resulted in uncomplicated ventilation with a normal capnography-curve.

Table 1

Demographic data, preoperative evaluation and data on the TTIP-ventilation of the four cases.

Case #	Age, yrs	Weight, kg	Height, cm	Sex	Preoperative evaluation					TTIP-ventilation		
					MC	Mouth opening, cm	Head and neck movement	Ability to prognath?	Beard	Insertion depth of the tube from incisors, cm	Volume inflated in the cuff, ml	Internal diameter of the tube, mm
1	52	80	NA	m	III	> 4	> 90°	yes	no	10	20	8.5
2	68	62	180	m	I	NA	> 90°	yes	yes	13	20	6.0
3	51	54	178	m	I	> 4	> 90°	yes	yes	10	20	6.0
4	39	139	174	m	II	> 4	> 90°	yes	no	14	20	8.5

NA = Information not available. MC = Mallampati Class (8).

Case 4

Severely obese patient scheduled for removal of parotid tumour. Dentition was normal.

Mask ventilation failed after which TTIP ventilation was established and allowed problem-free ventilation (Fig. 4) with a normal capnography curve. The patient was then given a muscle relaxant and the subsequent endotracheal intubation was uneventful.

In none of the cases was there clinical or stethoscopic indication of gastric insufflation or signs of pharyngeal damage. None of the patients was desaturated during the course of anaesthesia.

Discussion

We present a technique, TTIP ventilation, which quickly and efficiently established a free airway and ventilation in four cases with failed mask ventilation. The technique is minimally invasive and easily acquired. The necessary equipment, a standard cuffed endotracheal tube, is cheap and omnipresent.

Mechanism of action of TTIP ventilation

Two common reasons for failure of mask ventilation are poor mask fit or supraglottic obstruction. Both reasons for failure are corrected by TTIP ventilation. Proper seal is obtained by a combination of the cuff sealing against pharyngeal mucosa and the additional closure of the mouth and nostrils. Supraglottic obstruction is avoided by placement of the tip of the tube posteriorly to the tongue.

When performing TTIP ventilation the tip of the chin is inherently lifted thus making chin lift an integrated part of the technique. Even an anaesthetist with a small hand can perform this technique on a patient with a large head (Fig. 4).

It is possible to perform TTIP-like ventilation via the nasal route (9) but this is not the first choice because the passage of a tube through the nose bears the

inherent risk of nasal bleeding, submucosal tunnelling and turbinate avulsion. However these reservations do not apply if the oral route is precluded and nasal intubation is necessary.

Several supraglottic airway devices have appeared in recent years. Many of these devices have been advocated with too little demonstration of clinical utility (10) and it is unlikely that every anaesthetist could or should gain experience with each of these techniques. We think that there is a place for this new technique because the equipment, the endotracheal tube, is familiar to all anaesthetists, is omnipresent and TTIP ventilation takes a few seconds to establish. In case of failure it can quickly be abandoned in favour of other techniques.

In all the cases presented there were no clinical or stethoscopic indication of gastric insufflation. The tip should only be inserted far enough to establish ventilation and low inspiration pressure should be employed. Air insufflated into the upper airway follows the path of lowest resistance. As long as the tip of the tube and the side- (Murphy-) hole are not both in the oesophagus, the air will enter the airway and the likelihood of gastric insufflation is not greater than with mask ventilation. The optimal insertion depth of the tube tip during TTIP ventilation remains to be established.

It is possible that ventilation would have been easier if a muscle relaxant had been applied, but we do not know. It is the policy in our unit to establish ventilation before applying a muscle relaxant, except if laryngeal spasm is suspected.

In our case series we successfully applied TTIP ventilation after mask ventilation combined with oro-pharyngeal airways and two-hand mask ventilation had failed. Alternatives at this stage include the use of a nasopharyngeal airway or tube, which has some inherent risks, especially of nasal bleeding. Another alternative is the use of a supraglottic airway device, in particular a laryngeal mask airway, however, this is not always available (5) or may fail. At each stage of

managing the airway it is crucial that failure of ventilation is immediately recognized so that a failing technique can be abandoned without delay. If ventilation is still impossible one should of course consider moving directly to tracheal intubation or ultimately cricothyrotomy or tracheostomy.

Tube tip in pharynx ventilation is unlikely to be more harmful than accepted standard procedures like placement of oral or nasal airways. This indicates that it may be appropriate to use TTIP ventilation as an alternative to placement of such devices in order to practise the technique.

The technique has not been applied in settings other than the operating theatre. It seems feasible to attempt the technique in other settings (for example prehospital) if one is faced with a failed mask ventilation/intubation and limited equipment available, before resorting to cricothyrotomy.

Future prospective studies are needed to optimize the technique of TTIP ventilation. These studies should aim at clarifying the ideal position of the tube tip, ideal volume in the cuff, success rate, learning curve for application and the performance compared to other techniques.

In conclusion, in all four cases TTIP ventilation allowed the anaesthetist, without the need for an assistant or additional equipment, to establish ventilation in case of failed facemask ventilation. Tube tip in pharynx ventilation was established in seconds and is a promising technique that warrants being included in the armamentarium of anaesthetists. Future prospective studies are needed to refine the technique and delimit its indications.

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