Awake tracheal placement of the Tritube® under flexible bronchoscopic guidance

Published: 02 Jul 2018

http://dx.doi.org/10.21466/ac.ATPOTTU.2018

Authors

Dr Kayathrie Jeyarajah [1]

kayajeyarajah@hotmail.com

Dr Imran Ahmad [2]

- [1] Senior Registrar, Anaesthetics, Guy's & St Thomas' NHS foundation Trust, london, United Kingdom
- [2] Consultant, Anaesthetics, Guy's & St Thomas' NHS Foundation Trust, London, United Kingdom

Summary

A 71-year-old male with hoarse voice was referred to our institution for panendoscopy. Previous radiotherapy for piriform fossa carcinoma resulted in a 'radiotherapy neck' and reduced neck extension. He also had a background of severe chronic obstructive pulmonary disease (COPD). In view of his anticipated difficult airway combined with airway pathology and COPD, we opted for awake tracheal placement of a novel tracheal tube, the Tritube®, and ventilation using the Evone® ventilator (Ventinova Medical B.V., Eindhoven, Netherlands). After successful awake placement of the flexible bronchoscope, the Tritube® was passed alongside, guided by a silk suture which was inserted through the lumen of the tube and then tied over the bronchoscope. Once correct placement was confirmed, the patient was successfully ventilated throughout the procedure with the Evone® ventilator. The narrow lumen of the Tritube® allowed adequate surgical access with the advantage of a definitive airway, whilst continuous ventilation was delivered. To our knowledge, this is the first reported case of an awake tracheal placement of the Tritube® with ventilation via the Evone® ventilator.

Introduction

Panendoscopy is performed to gain access to the laryngeal aperture or vocal cords for diagnostic or therapeutic interventions [1]. Traditionally these cases require placement of a microlaryngeal tube (MLT) or receive supraglottic, transglottic or transtracheal high-frequency jet ventilation (HFJV) [2,3]. However, HFJV carries a risk of barotrauma [4]. Airway management of these cases can be challenging when there is co-existing airway pathology and anticipated difficult airway, often with co-morbidities, making tube placement difficult and HFJV risky.

The Tritube® (Ventinova Medical B.V., Eindhoven, Netherlands) is a novel tracheal tube that has three lumens: a 2.4 mm ventilation lumen, a pressure measurement lumen and a cuff lumen [5]. It has an external diameter of 4.4 mm, and can be used as an intubating catheter, a definitive airway, or an extubating catheter [5]. Benefits of the Tritube® have been demonstrated, including advantages in airway obstruction, definitive airway protection and providing an effective seal of the lungs [5].

The Evone® (Ventinova Medical B.V., Eindhoven, Netherlands) is a novel small lumen ventilator that uniquely controls the ventilatory cycle by providing continuous flow during both inspiration and expiration. The expiratory flow is controlled by creating resistance to flow within the circuit, then overcoming that resistance with a suction mechanism. The continuous flow has no ventilatory pauses and is programmed to

result in increases and decreases in intratracheal pressures which are as linear as possible, thereby minimising energy dissipation by the lungs.

Awake tracheal intubation is well described as the gold standard technique for patients with anticipated difficult tracheal intubation [6-8], but the awake placement for the Tritube® is yet to be well described. We present a case where the Tritube® was successfully placed in an awake patient under flexible bronchoscopic guidance, then anaesthesia induced and the patient safely ventilated with the Evone® ventilator via the Tritube® catheter for a duration of 45 minutes.

Report

A 71-year-old male presented with a hoarse voice and was admitted for elective panendoscopy, 18 months after receiving radiotherapy for a pyriform fossa tumour. His past medical history was significant for chronic obstructive pulmonary disease (COPD) with limited exercise tolerance of up to 200 yards. The airway examination revealed limited neck extension, mouth opening of 3 cm, a Mallampati score of 3 and radiotherapy changes to the neck. The remaining airway assessment was unremarkable and the patient was appropriately fasted.

In the operating theatre, standard monitoring in line with AAGBI guidelines was applied along with bispectral index monitoring (BIS), and intravenous access obtained. The patient was then prepared for awake tracheal intubation, supplementary oxygen was delivered by applying Optiflow™ (Fisher & Paykel Healthcare, Auckland, New Zealand) at a rate of 50–70 l.min–1 with a fraction of inspired oxygen concentration (FiO2) of 1.0. Conscious sedation was initiated with a propofol effect site concentration (Marsh model) of 0.6 µg.ml–1 and remifentanil effect site concentration 2 ng.ml–1 to achieve a Ramsay scale of 2 and BIS > 75). Topicalisation of the oropharynx was achieved by spraying 10% lignocaine (total of 500 mg) and 4% lignocaine (total of 600 mg) via a mucosal atomiser device.

Oral awake tracheal intubation was performed with a flexible bronchoscope (KARL STORZ, Slough, UK) and the Tritube® was secured alongside the bronchoscope scope with a looped silk suture that was passed through the Tritube® then looped over the end of the flexible bronchoscope, in a similar technique to standard bronchial blocker insertion (Fig. 1). The Tritube® was then uneventfully advanced alongside the bronchoscope and into the trachea, guided by the silk suture. The tube position was confirmed prior to removing the bronchoscope, anaesthesia was then induced by increasing the target controlled infusion doses of propofol and remifentanil, followed by cuff inflation and commencement of ventilation via the Evone® ventilator. Anaesthesia was maintained with propofol effect site concentration of 3 µg.ml–1 and remifentanil effect site concentration 5 ng.ml–1. Atracurium 20 mg was administered prior to balloon dilatation.

The surgical suspension was removed after 45 min. End-tidal CO2 (ETCO2) was around 4.0 kPa and Airway pressures remained < 18 cmH2O throughout the surgical procedure. Following uneventful surgery, the intravenous anaesthesia was ceased, muscle paralysis reversed with neostigmine 2.5 mg and glycopyrrolate 0.5 mg and the airway carefully suctioned. The Tritube® was removed uneventfully when consciousness and spontaneous respiration returned. The patient was then transferred to the recovery area and back to the ward 30 min later. Oxygen saturation remained 100% throughout the awake intubation and for the duration of the surgery.

Discussion

Airway management, oxygenation and ventilation for panendoscopy can be complicated in patients with anticipated difficult airways, airway pathology or co-existing respiratory disease. If an awake tracheal intubation technique is chosen, then oxygenation, topicalisation and sedation must all be titrated judiciously to allow for safe and comfortable placement of the flexible bronchoscope and tracheal tube. The surgical procedure must also be considered, as any tracheal tube may hinder surgical access. In such cases, an HFJV

technique may be considered to allow for a fine bore or tubeless oxygenation technique, but this has the risk of causing barotrauma and may require additional interventions especially if there is an associated difficult airway.

HFJV can be delivered by three methods: a) supra-glottic via the suspension laryngoscope; b) trans-glottic via a jetting catheter; or c) trans-tracheal via a cannula placed through the cricothyroid membrane [9,10]. There are advantages and disadvantages to each technique. Sub-glottic jet ventilation allows tubeless ventilation of the trachea, thereby offering the surgeon excellent access to the glottis and trachea, however, there is movement due to the high pressure jetting, a risk of desaturation due to inadequate flow of oxygen into the trachea and the risk of barotrauma [4]. Trans-tracheal jet ventilation has the advantage of bypassing the glottis by direct placement through the cricothyroid membrane, however, there is a risk of kinking, displacement, or incorrect placement of the catheter leading to surgical emphysema [9,10]. Low-frequency jet ventilation can be performed manually using the Manujet® (VBM Medizintechnik GmbH, Sulz am Neckar, Germany). The injector is connected to the side-port of the suspension laryngoscope and intermittent ventilation given.

The Tritube® is unique in having multiple functions as an intubating catheter, a definitive airway and extubating catheter. Kristensen et al. [5] described the Tritube® in seven adult patients with airway narrowing or whose surgical access was facilitated by this small-bore tracheal tube. Adequate ventilation was achieved in all patients and intratracheal pressure was maintained between 5 and 20 cmH2O. They reported that the Tritube® "facilitated tracheal intubation and provided unprecedented views of the intubated airway during oral, pharyngeal, laryngeal or tracheal procedures." Additionally, they state that "this technique has the potential to replace temporary tracheostomy, jet-ventilation or extra-corporeal membrane oxygenation in selected patients." Kristensen et al. used a flexible bronchoscope to place a guide wire in the trachea the bronchoscope was then removed, leaving the guidewire in the trachea.
The Tritube® was then placed under the guidance of an angulated video laryngoscope, using the guidewire to help correct placement into the trachea.

The technique we describe for insertion of the Tritube® guided by a silk suture in an awake patient is novel, as is the use of the Evone® ventilator. The advantages of this technique in a patient with anticipated difficult airway, severe COPD combined with airway pathology, is that we performed a safe awake tracheal placement of the flexible bronchoscope followed by establishing a definitive airway with the Tritube®. The narrow bore cuffed tube facilitated optimum surgical access whilst enabling monitoring of the ETCO2. Moreover, ventilation by Evone® is at low pressures, where the common pitfalls of jet ventilation such as barotrauma can be avoided. The Tritube® also enabled safe extubation. As such the patient received an anaesthetic with safe handling of the airway with optimal ventilation and safe perioperative care.

The limitations of the technique include the technical challenges with the placement of the Tritube® with the silk suture alongside the fibreoptic scope. The silk suture was removed once the Tritube® was placed in the trachea by pulling withdrawing it through the ventilation lumen of the Tritube®. This carries the theoretical risk of losing the suture within the airway and adds potential technical difficulty. An alternative technique could, therefore, be to use an awake videolaryngoscopy technique to achieve tracheal intubation without the use of a silk suture.

We have had personal communication with Professor Enk, inventor of the Tritube® and Evone® who believes this to be the first report of a patient who underwent successful awake placement of the Tritube® with this technique. We have demonstrated that the Tritube® can be used for awake tracheal intubation and the Evone® for low-pressure ventilation in patients undergoing airway surgery.

Acknowledgements

Published with the written consent of the patient.

Competing Interests

No external funding and no competing interests declared.

Image

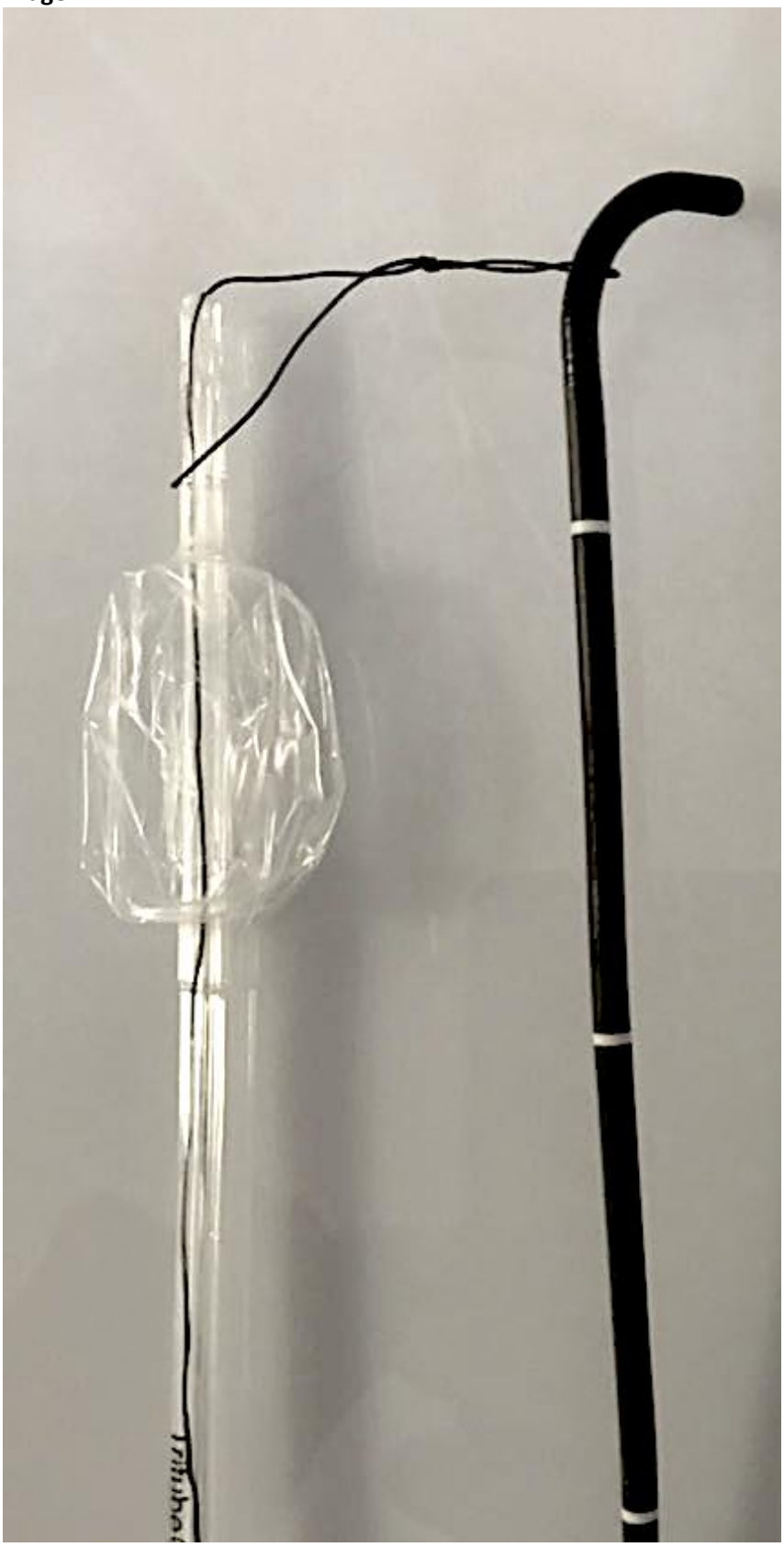

Figure 1. Tritube with silk suture through lumen of the tube tied over the bronchoscope.

References

1 Stoeckli SJ, Zimmermann R, Schmid S. Role of routine panendoscopy in cancer of the upper aerodigestive tract. Otolaryngology Head Neck Surgery 2001; 124: 208-212.
2 Ihra G, Gockner G, Kashanipour A, Aloy A. A high-frequency jet ventilation in European and North American institutions: Developments and clinical practice. European Journal Anaesthesiology 2000; 17: 418-430.
3 Rosenstock CV, Thøgersen B, Afshari A, et al. Awake fibreoptic or awake video laryngoscopic tracheal intubation in patients with anticipated difficult airway management—a randomized clinical trial. Anesthesiology 2012; 116: 1210-1216.
4 Evans E, Biro P, Bedforth N. Jet ventilation. Continuing Education in Anaesthesia Critical Care & Pain 2007; 7: 2-5.
5 Kristensen MS, De Wolf MPW, Rasmussen LS. Ventilation via the 2.4 mm internal diameter Tritube® with cuff – new possibilities in airway management. Acta Anaesthesiologica Scandinavica 2017; 61: 580-589.
6 El-Boghdadly K, Onwochei DN, Cuddihy J, Ahmad I. A prospective cohort study of awake fibreoptic intubation practice at a tertiary centre. Anaesthesia 2017; 72: 694-703.
7 Apfelbaum JL, Hagberg CA, Caplan RA, et al. Practice guidelines for management of the difficult airway: an updated report by the American Society of Anesthesiologists Task Force on management of the difficult airway. Anesthesiology 2013; 118: 251-270.
8 Frerk C, Mitchell VS, McNarry AF, et al. Difficult airway society 2015 guidelines for management of unanticipated difficult intubation in adults. British Journal of Anaesthesia 2015; 115: 827-848.
9 Patel A, Rubin JS. The difficult airway: The use of subglottic jet ventilation for laryngeal surgery. Logopedics Phoniatrics Vocology 2009; 33: 22-24.
10 Ross-Anderson DJ, Ferguson C, Patel A. Transtracheal jet ventilation in 50 patients with severe airway compromise and stridor. British Journal of Anaesthesia 2011; 106: 140-144.