British Journal of Anaesthesia **104 (4):** 501–4 (2010)
doi:10.1093/bja/aeq024 Advance Access publication February 25, 2010

BJA

ETView tracheoscopic ventilation tube for surveillance after tube position in patients undergoing percutaneous nephrolithotomy

M. Barak[1 3]*, V. Putilov[4], S. Meretyk[2 3] and S. Halachmi[3 5]

[1]Department of Anesthesiology and [2]Department of Urology, Rambam Health Care Campus, Haifa 31096, Israel. [3]Bruce Rappaport Faculty of Medicine, Technion-Israel Institute of Technology, Haifa, Israel. [4]Department of Anesthesiology, R. Ziff Hospital, Zfat, Israel. [5]Department of Urology, Bnei-Zion Hospital, Haifa, Israel

**Corresponding author. E-mail: m_barak@rambam.health.gov.il*

Background. Tracheal tube (TT) displacement during general anaesthesia may result in life-threatening complications and continuous direct vision of the position of the tube may enable safer management. The ETView tracheoscopic ventilation tube (TVT^{TM}) is a single-use TT incorporating a video camera and a light source in its tip. The view from the tip appears continuously on a portable monitor in the anaesthetist's vicinity. This study was designed to test the ETView TVT^{TM} in monitoring the TT position during general anaesthesia.

Methods. In this prospective study, the ETView TVT^{TM} was used to ventilate the lungs of 30 adult patients undergoing percutaneous nephrolithotomy (PCNL), which required changing patient position three times. During surgery, the anaesthetist followed the carinal view on the ETView TVT^{TM} portable monitor. Tube movement within 1 cm was recorded, as was the need for repositioning of the tube when the carina was not seen on the camera monitor.

Results. During anaesthesia, tiny movements synchronous with heart beats and lung ventilation were observed. Tube movement of 1 cm was detected in eight (26%) patients. In two (7%) patients, the carina was no longer viewed after moving to the lithotomy position and the tube was repositioned. None of the events was associated with changes in oxygen saturation, end-tidal CO_2, or airway pressure.

Conclusions. We found that the ETView TVT^{TM} facilitated surveillance of tube position by providing a clear high-quality view of the carina, throughout PCNL with several changes of patient position.

Br J Anaesth 2010; **104**: 501–4

Keywords: anaesthetic techniques, fibreoptic; complications; equipment, airway; intubation, intratracheal; surgery, urological; ventilation, mechanical

Accepted for publication: January 14, 2010

Tracheal tube (TT) displacement from its proper position above the carina may result in life-threatening complications.[1] If the tube is advanced into a main bronchus, single lung ventilation can occur causing volume trauma or pneumothorax in the ventilated lung and atelectasis in the non-ventilated lung. If the TT is withdrawn proximally, there is a risk of inadvertent extubation. These scenarios are more likely if the patient's position is changed during general anaesthesia, as demonstrated by early radiographic tests and later fibreoptic bronchoscope studies.[2–5] Unfortunately, the anaesthetist can often only detect tube movement from indirect signs such as increased airway pressure or decreased oxygen saturation. Currently, there is no tool for direct continuous monitoring of the TT position.

The aim of this study was to evaluate the ETView tracheoscopic ventilation tube (TVT^{TM}) (ETView Ltd, Misgav, Israel) for surveillance of tube position during general anaesthesia. The ETView TVT^{TM} is a single-use TT, which is available in sizes of 7.0, 7.5, and 8.0 mm internal diameter. The external structure, wall thickness, and length of the ETView TVT^{TM} are similar to the standard TT. The ETView TVT^{TM} incorporates a mini-video camera, 2 mm in diameter, and a light source embedded

Fig 1 The ETView TVT^{TM}. The camera is embedded at the tip of the tube.

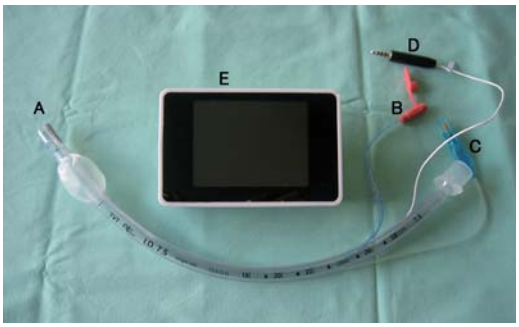

Fig 2 The ETView TVT^{TM} tube and portable monitor. (A) The tube tip with camera embedded in it. (B) Port that facilitates clearing the camera in case it was covered with secretions. (C) Tube pilot balloon. (D) Plague wire that connects to the monitor. (E) The portable monitor.

in the tip of the tube (Fig. 1). The view from the TT tip appears continuously on a portable monitor available in sizes of ~9 or 18 cm and can be battery or cable operated (Fig. 2). Resistance to air flow through the various ETView TVT^{TM} sizes is reported by the manufacturer to be comparable with the standard TT. The ETView TVT^{TM} has the US Food and Drug Administration approval and CE marking, is available in Europe and North America, and has been used in a study of 80 patients who underwent lung resection in Italy.[6]

Methods

This prospective study of 30 adult patients undergoing elective percutaneous nephrolithotomy (PCNL) with combined general–epidural anaesthesia in our hospital was approved by our local Ethics Committee and all patients gave informed consent. PCNL was chosen as this procedure requires several changes in patient position and the risk of tube movement is relatively high. In addition, during part of the procedure, the patient is distant from the anaesthetist, and access to the TT is difficult. Exclusion criteria were: American Society of Anesthesiologists (ASA) class $\geq$IV, pregnancy, patient weight $>$120 or $<$45 kg, known tracheal pathology, and patients at risk of gastric content regurgitation.

On the day of surgery, patients were premedicated with metoclopramide 10 mg and diazepam 10 mg p.o. On

Fig 3 The anaesthetist positions the ETView TVT^{TM} in place, guided by the view on the portable monitor.

arrival in the operating theatre, patients were monitored with non-invasive arterial pressure, ECG, and pulse oximeter, and i.v. arterial cannulae were placed. An epidural catheter was inserted in the midline approach, at the level of L 1–2. After preoxygenation of the patients' lungs for 5 min, anaesthesia was induced with propofol (2–3 mg kg^{-1}) and fentanyl (0.001–0.002 mg kg^{-1}), followed by vecuronium (0.08 mg kg^{-1}) i.v.. Endotracheal intubation was performed by one of two anaesthetists (M.B. and V.P.), each with more than 4 yr experience. Both had performed more than three intubations with the ETView TVT^{TM} before beginning the study and both were experienced in bronchoscopy, and hence familiar with bronchial views. The ETView TVT^{TM} size 7.5 was used in all patients; it was fixed with an adhesive tape and a cotton band when the picture of the carina was clear on a 9 cm ETView TVT^{TM} camera monitor (Fig. 3). After endotracheal intubation and tube fixation in the supine position, the patient was advanced to the distal end of the operating table and moved to the lithotomy position for cystoscopy and insertion of a ureteric catheter under radiographic guidance. The patient was then turned to the prone position for the PCNL. After completion of the procedure, the patient was turned to the supine position and the trachea extubated. During surgery, the anaesthetist followed the carinal view on the ETView TVT^{TM} portable monitor to detect any tube movements (Fig. 4). Using the carina as the point of reference, movement distances were estimated according to the number of tracheal cartilage rings seen: movement of less than two tracheal rings was defined as a movement of 1 cm. All tube movements and the need for repositioning of the tube when the carina was not seen on the camera monitor were recorded. The ETView TVT^{TM} camera and monitor have no alarm, and their utility relies on the judgement of the anaesthetist.

PCNL involves approaching the kidney from its upper pole with the attendant risk of pneumothorax, so we