# Is the move to the routine use of small endotracheal tubes evidence based?

*H Jones, V Mitchell*

## INTRODUCTION

Traditionally size 9 and 8 endotracheal tubes (ETTs) for men and women respectively have been used for anaesthesia. There is evidence to support this practice, but there is also growing evidence for the use of smaller tubes.

## ADVANTAGES OF LARGER TUBES

It is well known that reducing the diameter of a tube decreases flow and increases work of breathing. According to the Hagen-Poiseuille equation, in conditions of laminar flow, resistance is inversely proportional to the fourth power of the radius, therefore halving the tube diameter decreases flow by a factor of 16. Each millimetre decrease in tube diameter increases the tube resistance by between 25% and 100%, and increases the work of breathing by up to 150% depending on minute volume.

An advantage of large tubes is the ability to pass suction catheters and bronchoscopes to perform tracheobronchial toilet. The impact of secretions accumulating on their internal surfaces is also less significant. While a disadvantage of smaller tubes becomes clear when considering the problems of high cuff pressures.

More air is needed to inflate the cuff of a smaller tube to effect a seal against the tracheal wall, because its external diameter is much less than that of the trachea. If this small tube has a low volume cuff, only a narrow band is in contact with the tracheal wall. The pressure exerted can easily exceed 30 cm $H_2O$ and obstruct mucosal blood flow. Although most tubes in routine use have high volume, low pressure cuffs, it is sensible to monitor cuff pressure especially during nitrous oxide anaesthesia or prolonged ventilation (Calder and Pearce, 2005).

**H Jones** is Airway Fellow, **V Mitchell** is Consultant Anaesthetist, University College Hospital, Grafton Way, WC1E 6DB

*Correspondence to: H Jones*

## ADVANTAGES OF SMALLER TUBES

The use of small ETTs reduces the trauma of intubation. In one study, nearly 50% of patients complained of sore throat and hoarseness when they were intubated with tubes greater than 7 mm in diameter (Calder and Pearce, 2005). In contrast, in a personal series of 6000 intubations using size 6 mm tubes for females and 7 mm tubes for males, Koh et al (1998) reported no cases of hoarseness. Even after short periods of intubation, Avrahami et al (1995) were able to detect abnormalities in 86 out of 100 computed tomography (CT) scans of the larynx performed 6 months later.

If intubation is difficult, a small tube may increase the chance of success as it is less likely to obstruct the view of the laryngeal inlet during insertion (Stenqvist, 1979). It is easier to pass a smaller tube without making contact with the glottis, so reducing the chance of difficulty in passing the tube through the vocal cords and inadvertent oesophageal intubation.

Ovassapian and Randel (1995) studied the ease of passage of different size tubes over a fibrescope, and established that smaller tubes are easier to pass. When using the nasal route for intubation damage can be done by passing large tubes blindly; entire conchae have been amputated. Small tubes are also less likely to cause bleeding from the highly vascular mucous membrane of the nose (Calder and Pearce, 2005).

The additional inspiratory work of breathing owing to a small tube is overcome by positive pressure ventilation. Two studies have shown that distal inflation pressures are not increased when smaller tubes were placed (Stenqvist et al, 1979; Koh et al, 1998). In Koh's study this was true even when the patients were turned prone. Another report found that, in spontaneously breathing patients, 6 and 7 mm tracheal tubes are well tolerated and the extra work of breathing imposed (as compared to the conventional 8 or 9 mm tube), is only likely to be a problem in patients with critical respiratory compromise (Koh et al, 2005).

## CONCLUSIONS

Anaesthesia in adult patients is unlikely to need prolonged ventilation post-operatively, lends itself to the safe choice of a small ETT. Their use offers advantages to the anaesthetist and patient in a number of ways, principally by their relative ease of insertion and by reducing the incidence of sore throat. HM

*Conflict of interest: None*

Avrahami E, Frishman E, Spierer I, Englender M, Katz R (1995) CT of minor intubation trauma with clinical correlations. *Eur J Radiol* **20**(1): 68–71

Calder I, Pearce A (2005) Core Topics in Airway Management. Cambridge University Press

Koh K, Hare J, Calder I (1998) Small tubes revisited. *Anaesthesia* **53**(1): 46–50

Ovassapian A, Randel GI (1995) The role of the fibrescope in the critically ill patient. *Crit Care Clin* **11**(1): 29–51

Stenqvist O, Sonander, Nilsson K (1979) Small endotracheal tubes: ventilator and intratracheal pressures during controlled ventilation. *Br J Anaesth* **51**(4): 375–80

Anaesthetic and critical care dilemmas are coordinated by **Dr Natasha Curran** and **Dr Ramani Moonsinghe**, Research Fellows at the Centre for Anaesthesia, UCL, London

Ideas for future dilemmas can be sent to Kate Saunders hmed@markallengroup.com