

# Should endotracheal cuff pressure be routinely measured during elective surgery?

The pressure exerted by an endotracheal tube cuff against the tracheal wall depends on the compliance of the trachea and cuff. Endotracheal tube cuff pressure is increased by factors including patient position, head position, cuff position, cuff volume, temperature and nitrous oxide anaesthesia. Pressure measured at the pilot balloon of an endotracheal tube cuff is considered a good estimate of the pressure exerted onto the tracheal mucosa by the cuff. The pressure in the endotracheal tube cuff can be determined with a relatively inexpensive small aneroid cuff pressure manometer. This article explores whether endotracheal tube cuff pressure should be routinely measured during elective surgery.

## Reasons for measuring cuff pressure

Since the venous and lymphatic pressures of tracheal mucosa are 16 cmH<sub>2</sub>O and 4–7 cmH<sub>2</sub>O respectively, endotracheal tube cuff pressure maintained above 30 cmH<sub>2</sub>O may impair venous and lymphatic drainage of the trachea. Blood flow in the cartilaginous anterolateral part of the trachea is more compromised at pressures over 30 cmH<sub>2</sub>O and obstructed at pressures over 50 cmH<sub>2</sub>O in normotensive patients than the more distensible posterior tracheal membrane (Brimacombe et al, 1999).

Serious complications reported secondary to tracheal tube overinflation include: recurrent laryngeal nerve palsy, mucosal ischaemia, ulceration and bleeding, loss of ciliary function, tracheal granuloma, stenosis and rupture, non-malignant tracheo-oesophageal fistula, vocal cord paralysis, post-extubation stridor and tracheomalacia. The true incidence of these complica-

tions is unknown, since they may not be diagnosed or investigated.

The most frequently reported symptoms following tracheal intubation are sore throat and hoarseness with an incidence between 15% and 80% (Bennet et al, 2000). A large multicentre trial (over 500 patients) found a higher incidence of postoperative sore throat ( $P=0.03$ ), hoarseness ( $P=0.001$ ) and blood-streaked expectorations ( $P=0.002$ ) in patients where cuff pressure monitoring was not used than in those who had aneroid cuff pressure measurement (Liu et al, 2010).

Palpation of the endotracheal tube pilot balloon is common practice, but studies have demonstrated the inability of anaesthetists, intensive care physicians and nurses to accurately determine endotracheal tube cuff pressure by palpation alone.

## Reasons for not measuring cuff pressure

The influence of limiting endotracheal tube cuff pressure on the incidence of sore throat is unclear. Sore throat and hoarseness are associated with different types of endotracheal tubes regardless of endotracheal tube cuff pressure. Intubation can cause sore throat with an incidence of 40% when uncuffed endotracheal tubes are used (Loeser et al, 1980). In addition, the incidence of dysphagia following intubation ranges between 15 and 94% and in some studies has not been associated with excessive endotracheal tube cuff pressures.

A randomized study of 126 patients concluded that, although the use of saline rather than air to inflate the endotracheal tube cuff during nitrous oxide anaesthesia lowers intra-cuff pressure, this is not an important factor in the development of sore throat or hoarseness postoperatively (Brimacombe et al, 1999). However, a drawback of a number of these studies is the lack of standardized intubating conditions, anaesthetic technique and use of adjuncts such as nasogastric tubes (Brimacombe et al, 1999). Furthermore, a case of tracheal dilatation and rupture despite careful monitoring and keeping cuff pressures below 30 cmH<sub>2</sub>O has been reported.

Finally, endotracheal tube cuff pressure measurement is not a minimum standard of anaesthetic monitoring in guidelines published by the Association of Anaesthetists of Great Britain and Ireland and American Society of Anesthesiologists.

## Conclusions

Cuff pressure measurement during anaesthesia has been recommended by some to limit the incidence of postoperative complications. Despite the ease with which endotracheal tube cuff pressure can be measured, such devices are not widely available in operating rooms and it does not appear to be widely practiced. Anaesthetic associations around the world have not committed to mandatory intraoperative endotracheal tube cuff pressure monitoring. Evidence suggests that cuff pressure may be an important contributing factor to the development of complications related to endotracheal tube, but morbidity secondary to endotracheal tube is invariably multifactorial. Presently there is insufficient long-term outcome evidence to warrant mandatory intraoperative cuff pressure monitoring. **BJHM**

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Anaesthetic and critical care dilemmas are coordinated by Dr Steven Cone and Dr Matthew Henley, Specialist Registrars in Anaesthetics, Royal Free Hospital, London

Ideas for future dilemmas can be sent to Rebecca Linssen [rebecca.linssen@markallengroup.com](mailto:rebecca.linssen@markallengroup.com)

**Dr M Ramadan** is Specialist Registrar, University College Hospital, London NW1 2BU, **Dr E Pushpanathan** is ST4 Anaesthetics, St. Thomas' Hospital, London and **Dr P Sultan** is Specialist Registrar, University College Hospital, London

Correspondence to: Dr M Ramadan ([mramadan@doctors.org.uk](mailto:mramadan@doctors.org.uk))