Leading Article

The role of tracheostomy in the adult intensive care unit

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Intubation of the human trachea has been practised since ancient times. There are reports of the Egyptians using tracheostomy for acute upper airway obstruction 3,500 years ago and its use was described in Ancient Greece in the year 100 BC by Asclepiades. A variety of methods to secure the airway have since been devised. Orototracheal tubes were first used during anaesthesia by MacEwan in 1878, and the idea was further developed by Magill and Rowbotham in the 1920s. Transglottic tracheal intubation became popular in anaesthetic practice with the advent of intraoperative muscle paralysis, after 'curarization' was described by Griffiths and Johnson in 1942. The contemporary technique of surgical tracheostomy was first described in 1909 by Jackson. Despite the life-saving value of intubation in the management of the critically ill, much controversy still surrounds the indications for, and complications associated with, the alternative methods employed for securing the airway. The paper by Gunawardana published in this journal adds further fuel to the raging fire of debate concerning these issues.

The indications for tracheal intubation during intensive care, are well established. It provides security against airway obstruction and aspiration of pharyngeal content in the obtunded/unconscious patient, and enables ventilatory support in the presence of respiratory failure. Tracheal access also allows regular clearance of broncho-pulmonary secretions by suctioning, usually combined with formal physiotherapy. The route used, timing and subsequent management of tracheal cannulation, however, remain issues of contention.

Most critically ill patients requiring intubation, are initially managed with a transglottic, cuffed, tracheal tube. This may be introduced via the nose or mouth and each route has its advocates. Nasal intubation allows more stable fixation of the tube (the prime reason for its frequent use in children), and is often claimed to be better tolerated. There is little objective evidence to support the latter statement, which seems unlikely, since both options require transit through the glottis, the most sensitive region of the respiratory tract. Siting of a nasotracheal tube has been shown to be associated with prolonged insertion time, increased risk of hypoxia and greater haemodynamic instability. It has also been related to sinusitis, otitis media and ulceration of the nasal mucosa. Because of the narrow nasal orifice the maximum tube diameter is limited. This combined with its additional length, inevitably results in higher resistance to air flow and increased respiratory work during spontaneous ventilation. These problems are sufficient to contraindicate routine nasal intubation within our unit.

Oral intubation also has related problems. The tube is not easy to secure firmly, and the agitated patient may bite it, occluding the lumen. Oral hygiene is difficult to perform adequately and angular stomatitis may occur, usually related to the securing tapes. These difficulties can usually be prevented with good nursing care and in our opinion, this is the route of choice for perioperative and short-term intubation (see Figures 1 and 2).

There is undoubtedly a range of glottic pathology that can be related to the presence of an endotracheal tube. Laryngeal trauma may be caused during intubation, resulting in minor mucosal damage, vocal fold injury, or even arytenoid dislocation. Once positioned, pressure from and movement of the tube may provoke glottic ulceration, granuloma formation and ultimately laryngotracheal stenosis, reported to occur in 12% of patients after 11 days. In an attempt to avoid these serious complications, it is accepted practice that patients needing prolonged intubation (i.e. more than 7–10 days) should have a sub-glottic tracheal tube sited via a tracheostomy. This is also said to improve patient comfort and reduce the need for sedation during the weaning period, whilst oral hygiene and enteral nutrition can be better provided. It is commonly stated that tracheostomy reduces both respiratory dead space and 'the work of breathing', although these benefits are
A patient intubated with an un-cut orotracheal tube, poorly secured and with inadequate support of the ventilator hoses.

Modern open surgical tracheostomy is still based on Jackson's classic paper, and is performed at the level of the second and third tracheal rings. Various types of tracheal incision have been recommended: a Bjork (inverted 'U') tracheal flap, an excised window, a vertical or transverse split. They have all been claimed to limit the risk of tracheal stenosis, whilst the flap technique was intended to prevent anterior misplacement of the tube (this technique has since been discredited).

Percutaneous tracheostomy was first described by Toye and Weinstein but it failed to attract significant support. A revised Seldinger guide-wire technique presented by Ciaglia, using a series of tracheal dilators, has provoked new interest. Several clinical studies have now been reported, airway access being obtained above the first, second or third tracheal ring. Initial evidence suggests that complication rates compare favourably with open surgery. It can be easily performed on the ward, using local anaesthesia, thus avoiding

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Table 1 Methods of prolonged intubation—advantages and problems
the hazards of patient transfer to the operating theatre, for example, loss of positive end expiratory pressure, inadequate monitoring and the risks of disconnection. Contraindications include obesity, goitre, paediatric patients and acute upper airway obstruction. The incidence of tracheal stenosis secondary to ‘high’ tracheostomy (immediately above or below the cricoideal ring), has long been described, and was further witnessed during the evaluation of cricothyroidostomy. The incidence of tracheal stenosis clearly recedes as the stoma is sited more distant from the larynx, this being the narrowest and most vulnerable region in the upper respiratory tract. In contrast, the lower the tracheostomy, the greater the risk of tracheo-innominate artery fistula formation. This dramatic complication is reported to occur in 0.4–0.6% of tracheostomies, although these estimates are from retrospective surveys. Some minor tracheal bleeding is first observed in 30% of cases. and should always be carefully investigated with a view to preventative surgery. Attempted first aid measures to control the haemorrhage should include hyper-inflation of the cuff and retrosternal digital pressure via an incision in the suprasternal notch (see Figure 3). Emergency surgery requires median sternotony and ligation/excision of the eroded artery. With an associated 75% mortality, every effort should be made to prevent this disaster. Consequently routine tracheostomy, whether surgical or percutaneous, should never be sited below the third tracheal ring.

Figure 3  Illustration showing digital compression technique for emergency control of massive haemorrhage due to tracheo-innominate artery fistula. Reproduced with permission from JAMA 220(4), p. 578. Copyright 1972, American Medical Association.
Sepsis is a constant threat in the Intensive Care Unit. Local infection of the tracheal stoma with a purulent discharge is common in those surgically fashioned, but seems to be less frequent in those created by the percutaneous technique.17 Nosocomial pneumonia is a particular risk, which has been shown to be increased by tracheostomy. In a prospective study by El-Naggar et al.,46 there was an eight-fold difference in the number of organisms isolated from the group treated with early tracheostomy. In addition there was a significant delay in extubating these patients. An alternative interpretation of the data might be that tracheostomy and nosocomial infection occurred more commonly in the more severely ill patients, the association only reflecting the nature of the underlying illness.

In conclusion, intubation is often an essential manoeuvre in the treatment of critical illness. It is associated with significant morbidity and mortality but it is arguable whether this is increased by the early use of tracheostomy. In adults, we recommend routine airway management via a flexible, cuffed (large diameter, high residual volume) oro-tracheal tube. Care is needed in minimizing tube mobility and avoiding excessive cuff pressure (greater than 30 mmHg), to prevent serious laryngotracheal injury. Tracheostomy should generally be reserved for patients requiring prolonged intubation, beyond 10–14 days, where weaning from ventilation is proving difficult. In this situation, percutaneous tracheostomy sited between the first and second tracheal rings, is our method of choice. Cricothyroidotomy and tracheostomy placed below the third ring should be avoided. There is a clear need for more randomized prospective trials, comparing the outcome of switching to tracheostomy in the second week, with persistent transglottic intubation.

References


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