The LMA Fastrach™ facilitates fiberoptic intubation in oral cancer patients

[Le ML Fastrach™ facilite l'intubation fibroscopique dans les cas de cancer de la bouche]

Sushma Bhatnagar MD,* Seema Mishra MD,* Rajeev Ranjan Jha MD,* Amit K. Singhal MD,†
Naresh Bhatnagar PhD*

Purpose: To compare ease of endotracheal intubation with the Intubating Laryngeal Mask Airway (ILMA) tracheal tube (TT; for LMA-Fastrach™) and regular PVC TT (Portex) for nasotracheal fiberoptic intubation in oral cancer patients with a difficult airway.

Methods: 40 patients of physical status ASA I–II with a history of previous oral cancer surgery and/or postoperative radiotherapy scheduled for oral cancer surgery were randomly allocated by sealed envelopes to undergo tracheal intubation with either the ILMA TT or a standard TT. Ease of nasal passage of the TT and ease of tracheal intubation over the fibroscope was assessed. Peak airway pressures were assessed intraoperatively and postoperatively for 12 hr.

Results: The use of the ILMA TT increased the ease of nasotracheal intubation by increasing the percentage of successful tube placements at the first attempt (80%) in comparison with standard TT (35%); ($P < 0.05$). Peak airway pressures were found to remain low with the ILMA TT. None of the patients experienced any airway related complications.

Conclusions: Use of a soft, flexible, nonkinking ILMA TT with a tapered tip design facilitates passage into the trachea over a fiberoptic bronchoscope and allows maintenance of lower airway pressures. The ILMA TT may be a useful adjunct for management of the difficult airway in oral cancer surgery.

Objectif : Comparer la facilité de l'intubation endotrachéale avec le tube endotrachéal (TE) du masque laryngé d'intubation (MLI, pour le ML Fastrach™) et le TE PVC (Portex) régulier pour l'intubation fibroscopique nasotrachéale quand l'intubation était difficile chez des patients atteints de cancer de la bouche.

Méthode : Quarante patients d'état physique ASA I–II opérés pour un cancer de la bouche et/ou ayant reçu une radiothérapie postopératoire ont été répartis au hasard pour être intubés avec le TE MLI ou le TE standard. La facilité de l'insertion nasale du TE et de l'intubation endotrachéale au-dessus du fibroscope a été évaluée. Les pressions

maximales des voies aériennes ont été notées pendant et après l'opération, pendant 12 h.

Résultats : L'usage du TE MLI a augmenté la facilité de l'intubation nasotrachéale en haussant le pourcentage de mises en place réussies au premier essai (80 %) en comparaison du TE standard (35 %) ; ($P < 0,05$) dans les cas d'intubation de grade I. Les pressions maximales des voies aériennes sont demeurées faibles avec le TE MLI. Il n'y a pas eu de complications liées aux voies respiratoires.

Conclusion : L'usage d'un TE MLI mou, flexible et armé, muni d'une pointe effilée, facilite le passage dans la trachée au-dessus du fibroscope bronchique et permet de maintenir de basses pressions dans les voies respiratoires. Le TE MLI peut être un accessoire utile dans les cas d'accès difficile aux voies aériennes en chirurgie de cancer buccal.

TRACHEAL intubation with the aid of fiberoptic bronchoscope (FOB) has improved the anesthesiologist's ability to manage a difficult airway in oral cancer surgery. Still, passage of the tracheal tube (TT) over the FOB may be difficult.¹ Resistance in response to advancement of the tube may be encountered at the laryngeal level.² This is a serious problem that can result in laryngeal trauma as well as delayed or failed intubation, and has potential to cause arterial desaturation.³ The surgical procedure in oral cancer surgery involves sharing the same field by surgeons, which limits the anesthesiologist's access to the airway.⁴ The procedure also requires frequent changes in positioning of the head and neck, which may cause kinking of the extra nasal portion of the TT.

Spiral wound silicon rubber tubes, because of their greater flexibility, facilitate orotracheal and nasotra-

From the Department of Anaesthesiology,* Institute Rotary Cancer Hospital, All India Institute of Medical Sciences; and the Department of Mechanical Engineering,† Indian Institute of Technology, New Delhi, India.

Address correspondence to: Dr. Sushma Bhatnagar, 2, North Avenue, IIT-Hauz Khas, New Delhi-110016, India.

E-mail: narbhat@hotmail.com; shumob@yahoo.com

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cheal fibreoptic intubation.^{5,6} Design of the TT tip⁷ and size of the tube⁸ have also been suggested to facilitate passage of the TT over the FOB. The Intubating Laryngeal Mask Airway TT (ILMA TT; LMA Fastrach™ endotracheal tube; (Laryngeal Mask Company Ltd., Nicosia, Cyprus) features flexibility, a tapered tip and non-kinking design even with sharp angulations. Use of the ILMA TT for fibreoptic orotracheal intubation has been shown to facilitate rapid atraumatic fibreoptic orotracheal intubation.⁹ The aim of the current study was to compare the ease of intubation between the ILMA TT (TT for LMA-Fastrach™) and regular PVC TT (Portex) for nasotracheal fibreoptic intubation in oral cancer patients with a difficult airway.

Material and methods

After institutional Research Ethics Committee approval, 40 patients ASA physical status I–II aged 18 to 60 yr scheduled to undergo elective surgery for oral cancer under general anesthesia with nasotracheal intubation were included. Specifically included were patients with a history of prior surgery and/or radiotherapy for oral cancer with probability of difficult intubation. After obtaining written informed consent, patients were randomly allocated using labelled, sealed envelopes to undergo endotracheal intubation with either the ILMA TT (Group 1) or with a standard TT tube (Portex Tracheal Tube, Sims Portex Limited, Hythe, Kent, UK); (Group 2).

Patients were premedicated with oral diazepam 5 or 10 mg on the night before and again on the morning of surgery. Glycopyrrolate 0.2 mg *im* was given to all patients 45 min before surgery. Oxymetazoline nasal drops were instilled in both nostrils two to three times 45 min before the scheduled time of operation. Preoxygenation was provided with 100% oxygen and morphine 0.1 mg·kg⁻¹ *iv* was administered. Anesthesia was induced with thiopentone or propofol in a dose sufficient to abolish eyelash reflex while at the same time 50% nitrous oxide in oxygen with increasing concentrations of halothane 0.5 to 3% volume were administered. A nasal airway (6.5–7.0 mm) was inserted in the nostril opposite to the one through which intubation was planned, and the breathing circuit was attached to it. After confirming the adequacy of positive pressure ventilation with the nasal airway, a neuromuscular blocking drug was administered and positive pressure ventilation continued. TT 7 mm were used in females, and 7.5 mm diameter tubes in males. During intubation, the patient's jaw was lifted upwards and forward by an assistant to improve visualization of the larynx, and the position was main-

TABLE I Scoring system for ease of passage of the tracheal tube through the nose

Grade	Ease of nasal insertion of the tube
1	Easy, normal passage
2	Passage with pressure and rotational movement
3	Change of tube to one size smaller required
4	Even one size smaller tube doesn't pass

TABLE II Scoring system for ease of tracheal intubation

Grade	Ease of tracheal intubation
1	No 'hold-up' encountered
2	Hold-up, relieved by rotation of the tube through 90° counter-clockwise
3	Hold-up, requiring more than one rotation of the tube, alteration in head or neck position, tongue traction or the use of a laryngoscope
4	Failure of fibrescope aided tracheal intubation

TABLE III Patient characteristics (mean ± SD for age and sex)

Variables	Group 1	Group 2	P-value
Age (yr)	46 ± 12.9	46.8 ± 11.2	0.836
Weight (kg)	56.6 ± 11.1	59.4 ± 15.8	0.523
Male: female	13:7	13:7	1.000

TABLE IV Ease of nasal insertion and of tracheal intubation

Grade	Group 1 (ILMA TT)	Group 2 (Standard TT)	P-value
Nasal passage grade	1 13 (65%)	15 (75%)	0.540
	2 6 (30%)	5 (25%)	
	3 1 (5%)	0	
	4 0	0	
Intubation grade	1 16 (80%)	7 (35%)	0.020
	2 4 (20%)	8 (40%)	
	3 0	4 (20%)	
	4 0	1 (5%)	

ILMA = Intubating Laryngeal Mask Airway; TT = tracheal tube.

tained until the TT was inserted successfully. Anesthesia was maintained with 60 to 70% nitrous oxide in oxygen, isoflurane, morphine and vecuronium. Patients were kept in the intensive care unit (ICU) for at least 24 hr. In all patients nasotracheal intubation was maintained overnight and the trachea was extubated the next day. Intubations were performed by a single anesthesiologist and graded on an arbitrary subjective scale (Table I). Ease of tracheal intubation over the fibrescope was scored according to

FIGURE 1 Peak airway pressures as a function of time.

four grades (Table II). Peak airway pressure (PAP) was recorded every hour for 12 hr after intubation. However, during surgical procedures PAP was closely observed for eight to ten hours on average.

Statistics

Twenty patients in each group were randomized. A post hoc analysis for the power of the study was undertaken using the correlation coefficient (r) from 0.55 to 0.91, alpha (α) = 0.05, and means and standard deviations for pre- and post-observations of the data separately. The power was > 90% (STATA 8.0 package, Stata Corp LP, Texas, TX, USA).

Demographic data are expressed as mean $\pm$ standard deviation. Unpaired t tests were used to compare continuous data and a Chi-square test was applied to nominal data. Airway pressures between groups were compared by a two-way ANOVA with post hoc analysis using a Bonferroni test. The Mann Whitney U test was used to compare ease of insertion between the two groups. SPSS 7.5 (SPSS Inc., Woking, UK) and STATA 8.0 statistical packages were used for the analyses. A P value (< 0.05) was considered significant.

Results

The two groups were similar with respect to age, weight and gender (Table III).

There was no statistically significant difference in ease of nasal passage between both groups (Table IV). One patient in Group 1 required a one-size smaller tube due to failure of passage of the designated size tube.

FIGURE 2 Intubation laryngeal tracheal tube (Fastrach™) and standard tracheal tube (Portex).

There was a significant difference in ease of intubation between both groups ($P = 0.02$) (Table IV). The number of successful tube placements upon first attempt was higher in Group 1 (80%) in comparison to Group 2 (35%); ($P = 0.02$). There was one failure in Group 2 which was ultimately resolved after changing the standard PVC TT to the ILMA TT.

Peak airway pressures were significantly higher between hours three and seven in Group 2 (Figure 1). One patient in each group had minor nasal bleeding during passage of the tube which in neither case interfered with intubation, and stopped immediately after an additional two to three drops of oxymetazoline. Three patients in Group 1 and one patient in Group 2 had minor epistaxis during extubation, which stopped with nasal compression and oxymetazoline drops. There were no airway related complications in any patient during their 24-hr ICU stay.

Discussion

Fibreoptic intubation has a well-established role in anesthetic practice and has revolutionized the management of patients presenting with known or suspected difficult intubation. This study demonstrates that following placement of the FOB into the trachea, intubation is easier with the ILMA TT than with a standard PVC TT. Also peak airway pressures are lower with the ILMA TT. The standard PVC TT is not reinforced with metal wire, as is the ILMA TT. Due to lack of reinforcement, the standard PVC TT tends to kink when bent which reduces the cross sectional area and in turn increases airway pressure. However tube reinforcement as with the ILMA TT prevents kink formation and helps to ensure that airway pressures remain constant. Postoperatively, patients tolerated the tube well and the incidence of epistaxis was similar in both groups.

The potential for a difficult airway in oral cancer patients is largely due to limited head and neck mobility and position, limited mouth opening, limited upper airway open space resulting from tumour, edema or previous surgery, distorted anatomy of the airway by tumour expansion or previous surgery, and fixation of the tissue of oral cavity, pharynx or larynx by tumours, surgical scar or radiation fibrosis.¹⁰ Factors associated with difficult railroading of the TT over the fibroscope include: large differences in diameter between fibroscope and TT,⁸ flexibility of the tube,^{5,6} tube tip design,^{5,7,9,11} and the technique and experience of the operator.

The ILMA TT, being made of silicone-based plastic, is soft and flexible and has a specifically designed tapered end as shown in Figure 2. This reduces the gap between the fibroscope and the tube. For this reason the ILMA TT has been shown to facilitate orotracheal intubation.¹² Our study lends further evidence to its usefulness in nasotracheal fibreoptic intubation. In a previous study where ILMA TT was used to facilitate fibreoptic intubation, 'holdup' of the ILMA TT was not observed in any of the 18 patients. Though it was anticipated that a nasotracheal intubation would be easier, we encountered 'holdup' in four patients requiring slight withdrawal and rotation of the tube. These obstructions to TT advancement have been due to a different cohort of patients, as previous studies were conducted in patients with normal airways, whereas our study was performed in oral cancer patients with a high probability of difficult intubation. Similarly, another TT known as Parker Flex-Tip Tube is associated with greater initial success rate of endotracheal intubation when compared to the standard TT, due to its novel tip design.¹³

Despite its advantages, the spiral wound tube has been associated with serious airway obstruction. Biting of the tube has been shown to cause permanent narrowing of the lumen^{14,15} but this is not a concern with the nasotracheal intubation, as in the case of the current study. Aneurysmal dilatation of the cuff also has been reported to cause obstruction, although new materials decrease this risk. One recent case report suggests that if a disposable tube is reused, obstruction may ensue and more importantly fibreoptic examination may fail to reveal the obstruction.¹⁶ With spiral wound tubes obstruction can occur due to bending at the connector,¹⁷ but inserting the connector up to the point where the spiral starts makes the occlusion unlikely. The ILMA TT has the additional advantage of a Murphy eye, in comparison to other flexometalic tubes, which prevent obstruction when the TT impinges on the tracheal wall.

In conclusion, our data suggest that the use of the soft, flexible, non-kinking ILMA TT with tapered tip design facilitates easy passage over a FOB into the trachea. Maintenance of the airway with this tube is also associated with lower airway pressures. Use of the ILMA TT should therefore be considered in the airway management of patients presenting for oral cancer surgery.

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References

- 1 Brull SJ, Wiklund R, Ferris C, Connelly NR, Ebbert J, Silverman DG. Facilitation of fiberoptic orotracheal intubation with a flexible tracheal tube. *Anesth Analg* 1994; 78: 746–8.
- 2 Katsnelson T, Frost EA, Farcon E, Goldiner PL. When the endotracheal tube will not pass over the flexible fiberoptic bronchoscope (Letter). *Anesthesiology* 1992; 76: 151–2.
- 3 Hughes S, Smith JE. Nasotracheal tube placement over the fibroscope laryngoscope. *Anaesthesia* 1996; 51: 1026–8.
- 4 Beckers HL. Use of stabilized, armoured endotracheal tube in maxillofacial surgery. *Anesthesiology* 1982; 56: 309–10.
- 5 Hakala P, Randell T, Valli H. Comparison between tracheal tubes for orotracheal fibreoptic intubation. *Br J Anaesth* 1999; 82: 135–6.
- 6 Ovassapian A, Yelich SJ, Dykes MH, Brunner EE. Fiberoptic nasotracheal intubation—incidence and causes of failure. *Anesth Analg* 1983; 62: 692–5.
- 7 Jones HE, Pearce AC, Moore P. Fibreoptic intubation. Influence of tracheal tube tip design. *Anaesthesia* 1993; 48: 672–4.
- 8 Koga K, Asai T, Latto IP, Vaughan RS. Effect of the size of a tracheal tube and the efficacy of the use of the laryngeal mask for fibroscope-aided tracheal intubation. *Anaesthesia* 1997; 52: 131–5.
- 9 Greer JR, Smith SP, Strang T. A comparison of tracheal tube tip designs on the passage of an endotracheal tube during oral fiberoptic intubation. *Anesthesiology* 2001; 94: 729–31.
- 10 Dougherty TB, Clayman GL. Airway management of surgical patients with head and neck malignancies. *Anesthesiol Clin North America* 1998; 16: 547–62.
- 11 Makino H, Katoh T, Kobayashi S, Bito H, Sato S. The effects of tracheal tube tip design and tube thickness on laryngeal pass ability during oral tube exchange with an introducer. *Anesth Analg* 2003; 97: 285–8.

- 12 *Lucas DN, Yentis SM.* A comparison of the intubating laryngeal mask tracheal tube with a standard tracheal tube for fibreoptic intubation. *Anaesthesia* 2000; 55: 358–61.
- 13 *Kristensen MS.* The Parker Flex-Tip tube versus a standard tube for fiberoptic orotracheal intubation. *Anesthesiology* 2003; 98: 354–8.
- 14 *Spiess BD, Rothenberg DM, Buckley S.* Complete obstruction of armored endotracheal tubes (Letter). *Anesth Analg* 1991; 73: 95–6.
- 15 *Brusco L Jr, Weissman C.* Pharyngeal obstruction of a reinforced orotracheal tube. *Anesth Analg* 1993; 76: 653–4.
- 16 *Paul M, Dueck M, Kampe S, Petzke F.* Failure to detect an unusual obstruction in a reinforced endotracheal tube with fiberoptic examination. *Anesth Analg* 2003; 97: 909–10.
- 17 *Cohen DD, Dillon JB.* Hazards of armored endotracheal tubes. *Anesth Analg* 1972; 51: 856–8.