Reports of Investigation

Limits of laryngeal mask airway in patients after cervical or oral radiotherapy

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Purpose: To test the efficacy of the LMA in patients with previous oral or cervical radiotherapy, without upper airway obstruction.

Methods: In nine patients after oral or cervical radiotherapy, efficiency of ventilation was assessed after induction of general anaesthesia and LMA insertion. Fibreoptic examination through the tube was performed to check the position of LMA

Results: In patients who had had oral radiotherapy, all five had limited mouth opening and in two, LMA insertion was difficult but permitted good ventilation. In the four patients who had had cervical radiotherapy, LMA insertion was easy but, in two, the lungs were difficult to ventilate and, in two, the lungs could not be ventilated and orotracheal intubation was required.

Conclusion: In patients with limitation of mouth opening after oral radiotherapy, LMA may represent an alternative to tracheal intubation. In patient with cervical sclerosis after radiotherapy; the use of LMA should be avoided.

Objectif : Tester l'efficacité du masque laryngé chez des patients ayant subi une radiothérapie orale ou cervicale, sans obstruction des voies aériennes supérieures.

Méthodes : Chez neuf patients ayant subi de la radiothérapie, la qualité de la ventilation a été appréciée après induction de l'anesthésie générale. Une fibroscopie à travers le tube a été effectuée pour apprécier la position du masque laryngé.

Résultats : Chez les patients qui ont eu une radiothérapie orale, cinq avaient une limitation de l'ouverture de bouche. Chez deux d'entre eux, la pose du masque a été difficile mais a permis une bonne ventilation. Chez les quatre patients ayant eu une radiothérapie cervicale, la pose a été facile ; la ventilation a été difficile chez deux d'entre eux et impossible chez les deux autres, nécessitant l'intubation trachéale.

Conclusion : Chez les patients ayant une limitation de l'ouverture buccale après radiothérapie orale, le masque laryngé peut être une alternative à l'intubation. Chez les patients ayant une sclérose cervicale après radiothérapie de sclérose cervicale consécutive à la radiothérapie, il faut éviter d'utiliser le masque laryngé.

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CERVICAL radiotherapy causes induration of the base of the tongue and difficulty in mouth opening and head extension. It induces difficulty in visualising the larynx and predisposes to difficult intubation.[1] Fibreoptic intubation is often difficult in patients with cervical radiotherapy because of anatomical changes.[2] In cases of difficult intubation without upper airway obstruction, general anaesthesia can be induced and oxygenation maintained either by face mask ventilation or by transtracheal jet ventilation during attempts at orotracheal intubation with or without fibreoptic control.[3] On the other hand, the Laryngeal Mask Airway (LMA) has been advocated for use in patients in whom the trachea has proved difficult to intubate.[4–7] In most clinical guidelines,[8] the use of the LMA is contraindicated in patient after cervical radiotherapy, although this recommendation has not been supported by prospective studies.[9]

The aim of this study was to test the efficacy of the LMA in patients with previous oral or cervical radiotherapy, without upper airway obstruction.

Methods

After informed consent, nine successive patients who had had previous cervical or oral radiotherapy and who were scheduled for short duration surgery were studied. Patients with upper airway obstruction were excluded. For each patient, intubation difficulty was assessed pre-operatively by Mallampati score,[10] neck extension and mouth opening. Limitation of mouth opening was defined as an interincisor gap < 25 mm. The LMA insertion was chosen because the surgical procedure was expected to be short and access to the head would be possible throughout the surgery. Transtracheal high frequency jet ventilation was available in case of failed face mask ventilation. After 10 min preoxygenation, general anaesthesia was induced with 1.5 $mg \cdot kg^{-1}$ propofol or 3 $mg \cdot kg^{-1}$ thiopentone and 2 $\mu g \cdot kg^{-1}$ fentanyl or 20 $\mu g \cdot kg^{-1}$ alfentanil. After confirmation of a patent airway by gentle manual ventilation, patients who had limitation of mouth opening received 0.1 $mg \cdot kg^{-1}$ vecuronium *iv*. An LMA size #4 was introduced by an experienced anaesthetist (for four patients the anaesthetist had a large experience of LMA, and for five patients the anaesthetist had a moderate experience of LMA). In each patient, fibreoptic examination was performed through the tube to check LMA position. Vecuronium 0.1 $mg \cdot kg^{-1}$ was injected in the case of glottis closure in patients who had not received vecuronium during induction. Tracheal intubation under direct laryngoscopy was performed when ventilation was not improved by a change in LMA size. To avoid glottic injury, blind intubation through the LMA was not attempted. Fibreoptic intubation through the LMA was not possible because of the respective diameters of the LMA and our fibreoptic bronchoscope.

Results

Four patients had had radiotherapy focused on cervical lymph nodes, resulting in cervical sclerosis and limitation in neck extension (Table I). Of the five patients who had oral radiotherapy, two had limited neck extension and all five a limited mouth opening (Table II). In all cases, face mask ventilation was easy after induction, surgery was performed and recovery was uneventful. An LMA size #3 was used on the first attempt in patients #6 and #9 because of the limitation of mouth opening and the low body weight (40 and 36 kg). Anaesthesia and airway management are summarised in Table III.

The technique was judged unsatisfactory on four occasions and was abandoned in two of these patients. On five patients, the LMA allowed normal ventilation. As the mouth opening of patients #8 and #9 was particularly narrow, the introduction technique is described:

Patient #8. This patient was opposed to tracheostomy under local anaesthesia. The surgeon was scrubbed and standing by in the operating room, ready to perform an immediate tracheostomy if required. After anaesthesia induction and face mask ventilation, 4 mg vecuronium *iv* was injected to increase the mouth opening. Insertion of an LMA size #4 between the incisor teeth was impossible. An LMA size #3 was introduced through the left side of the mouth. As the diameter of the distal part of the LMA (LMA #3 and #4: outer diameter = 15 mm) was larger than the retromolar space it was necessary to squeeze the proximal part of the tube to flatten it during the introduction of the LMA into the mouth. Once the LMA cuff was in the mouth, its correct placement in the hypopharynx was easy and permitted good ventilation, in spite of some compression of the airway tube at incisor level. Surgery was possible without difficulty. The LMA was easily removed by the anaesthetist at the end of the surgery.

Patient #9. After anaesthesia induction, it was possible to introduce an LMA size #3 through a space left by superior molar teeth removed previously. The LMA was introduced at the second trial and permitted spontaneous breathing throughout the procedure (80 min). The LMA was easily removed at the end of surgery when the patient was completely awake.

TABLE I Demographic and general information

Patient #	*Age (yr)*	*Weight (Kg)*	*Sex*	*History*		*Delay between radiotherapy and anaesthesia (months)*	*Surgery scheduled*
				Site	*Surgery*		
1	64	70	M	hypopharynx	hypopharyngectomy + lymphadenectomy	22	upper lip resection
2	63	65	M	oral cavity	mandibulectomy	2	osteosynthesis removal
3	65	90	M	oral cavity	mandibulectomy + lymphadenectomy	1	axillary lymphadenectomy
4	69	75	M	oral cavity	lymphadenectomy	2	axillary lymphadenectomy
5	70	55	M	sinus cancer	maxillary sinusectomy	5	upper lip resection
6	19	40	M	tongue cancer	glossectomy + lymphadenectomy	1	lymphadenectomy
7	61	69	M	left jaw cancer	mandibulectomy + lymphadenectomy	24	osteosynthesis removal
8	28	37	M	sinus cancer	maxillary sinusectomy	5	maxillary sinusectomy
9	32	36	F	undifferentiated cavum tumour	none	5	sinusectomy

TABLE II Pre-operative evaluation

Patient #	*Pre-operative radiotherapy*	*Pre-operative evaluation*			
		Mallampati	*Cervical sclerosis*	*Neck extension*	*Mouth opening*
1	Cervical	2	Yes	Limited	OK
2	Cervical	2	Yes	Limited	OK
3	Cervical	3	Yes	Limited	1.6 cm
4	Cervical	1	Yes	Very limited	OK
5	Oral	4	?	Limited	1.4 cm
6	Oral	4	Yes	Normal	1.2 cm
7	Oral	4	No	Normal	1.8 cm
8	Oral	4	No	Normal	0.7 cm
9	Oral	4	No	Limited	0.5 cm

Discussion

The main results of this study are that in patients who had had oral radiotherapy, LMA insertion was often difficult but permitted good ventilation. In the four patients who had had cervical radiotherapy, LMA insertion was easy but, in two, the lungs were difficult to ventilate and, in two, they were impossible to ventilate and orotracheal intubation was required.

In four patients with cervical sclerosis (1 to 4), LMA introduction was easy but positive-pressure ventilation was difficult. In each case, the vocal cords were not seen through the fibreoptic bronchoscope because of vestibular fold collapse. It is difficult to separate the respective effects of general anaesthesia and propofol on laryngeal muscular tone. During general anaesthesia with the LMA, glottis closure is often related to laryngospasm associated with an inadequate depth of anaesthesia. The hypnotic or muscle relaxant administration improves the clinical situation in most cases.[9] As muscle relaxant injection did not improve laryngeal opening in our patients, laryngospasm was an unlikely mechanism of larynx closure. However, no conclusion could be drawn on level of laryngeal muscle relaxation after vecuronium injection because muscular blockade was not monitored using the orbicularis oculi.[11] Failures of LMA always occurred in patients who had received radiotherapy to the lower part of the neck. Anatomical factors were, therefore, the more likely

TABLE III Anaesthesia and airway management

Patient #	*Drugs: doses (mg)*	*Size*	*LMA Insertion: n of attempts*	*Ventilation*	*Fibreoptic appearance*	*Management*	*Results*
1	propofol: 150 fentanyl: 0,1	4->3	easy: 1	OK but difficult	LMA correctly placed larynx closed	1-vecuronium: 7 mg 2-change to LMA #3	1-no change 2-improvement of ventilation
2	propofol: 200 fentanyl: 0,1	4	easy: 1	failed	glottis closure	1-vecuronium: 6 mg 2-orotracheal intubation	1-no change 2-succes
3	propofol: 200 fentanyl: 0,15	4	easy: 1	failed	glottis closure large epiglottis	1-vecuronium: 8 mg 2-orotracheal intubation	1-no change 2-succes
4	propofol: 200 fentanyl: 0,1	4	easy: 1	OK but difficult	glottis closure large epiglottis	1-vecuronium: 7 mg 2-deflating the cuff	1-no change 2-improvement of ventilation
5	thiopent.: 250 alfentanil: 1 vecuro: 3	4	difficult	OK	LMA correctly placed	–	–
6	propofol: 180 fentanyl: 0.15 vecuro.: 2	3	easy: 1	OK	LMA correctly placed	–	–
7	propofol: 150 fentanyl: O.05	4	easy: 1	OK	LMA correctly placed	–	–
8	propofol: 150 fentanyl: 0.15 vecuro.: 4	4->3	LMA 4, impossible LMA 3, difficult, lateral: 3	OK	LMA correctly placed	–	–
9	propofol: 150 fentanyl: 0.15 vecuro.: 4	3	difficult, lateral: 2	OK	LMA correctly placed	–	–

explanation for these failures. Indeed, fibreoptic examination showed that the LMA aperture was correctly placed in front of the glottis and that obstruction was related to laryngeal collapse. Propofol, by reducing laryngeal muscle tone,[12] may induce complete airway obstruction in patients with an abnormal larynx and hypopharynx. Post-radiotherapy oedema and laryngeal sclerosis were present but could not explain the complete obstruction because before and after anaesthesia, patients did not present any clinical sign of upper-airway obstruction. The presence of the LMA in a narrowed hypopharynx may compress laryngeal structures in an inextensible neck, so inducing glottis collapse. The improvement of ventilation after cuff deflation in patient #4 and after the replacement of an LMA size #4 by an LMA size #3 in patient #1 lends support to this hypothesis.

In patients with severe limitation of mouth opening (i.e., 0.7 and 0.5 cm in our cases #8 and 9), LMA introduction raised difficulties. We found these could be resolved by introducing the LMA through the lateral part of the mouth or the retromolar gap and by squeezing the tubular part to flatten it during passage between the teeth. In all the cases, positioning LMA in the hypopharynx was relatively easy, once the cuff had been passed beyond the dental arcade. In these patients, the radiotherapy fields did not reach the lower part of the neck and the integrity of the larynx was likely preserved; this may explain why the quality of ventilation was satisfactory.

In patients after cervical radiotherapy, most intubation techniques may become difficult. Awake fibreoptic intubation is usually proposed as a reference method.[2,13] This technique was not applied in all of our patients because of the difficulties related to the use of fibrescope in patients with previous cervical radiotherapy.[8,14] The use of the LMA in the management of anticipated difficult intubation has already been described in several circumstances[3,6-7] and it has been included in the ASA difficult airway algorithm.[15] In emergency situations or in patients with unanticipated difficult intubation, LMA may be used as a method of oxygenation and as a conduit for tracheal intubation. In patients whose lungs cannot be ventilated by a face mask, the LMA should be considered as a first treatment choice.

Patients with upper airway obstruction were excluded from this study because they should be tracheostomised or intubated awake under fibreoptic control.[13–14] It is likely that the use of the LMA should be probably avoided in these cases.

Conclusion

In patients with cervical sclerosis after radiotherapy, the use of LMA should be avoided because the LMA does not allow correct airway access. Furthermore, fibreoptic intubation through the LMA cannot be recommended, as the vocal cords were not seen during fibreoptic examination. Awake fibreoptic intubation after topical anaesthesia should remain the reference method in these cases. On the other hand, the LMA may offer an alternative to tracheal intubation in patients with severe limitation of mouth opening induced by oral radiotherapy, especially when nasal intubation is contraindicated. Nevertheless, the number of patients included in this study is too small to make a definitive recommendation.

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