Clinical Reports

Variations in ILMA external diameters: another cause of device failure

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Purpose: To report failure of insertion of #5 and #4 intubating laryngeal mask airways (ILMAs) in a patient with a mouth opening of just under 25 mm, and the variances among same-size ILMAs.

Clinical features: A 53-yr-old man with obstructive sleep apnea underwent elective ENT surgical repair. His mouth opening was just under 25 mm. Ventilation by mask was easy. Direct laryngoscopy failed after induction of anesthesia and neuromuscular block. Neither a #5 nor a #4 ILMA could be passed between the patient's teeth, despite different twisting manoeuvres. A #4 LMA was thus prepared as a conduit for fiberoptic intubation. Placement of the LMA was easy, as was fiberoptic-guided intubation. The LMA was removed over the tracheal tube (TT) to enable ENT surgery, and the further course was uneventful. Manual examination showed that, unlike others of the same type, the failed ILMAs were not sufficiently compressible either to allow insertion in this patient or to the 20 mm reported as the maximal outer dimension of the device. Radiological examination revealed that, at the point of the device where it is intended to be compressible, the silicone layer was thicker in the failed devices than in stock compressible ILMAs, and the end of the steel tube was not so sharply beveled.

Conclusion: Our inability to insert an ILMA in a patient with an interdental distance of just under 25 mm was because the device was not sufficiently compressible although the manufacturer states the maximal outer dimension to be 20 mm.

Objectif : Rapporter l'échec de l'insertion de masques laryngés d'intubation n^{os} 5 et 4 (MLI) chez un patient dont l'ouverture de la bouche était d'un peu moins de 25 mm et préciser les différences entre les MLI de même taille.

Éléments cliniques : Un homme de 53 ans, souffrant d'apnée du sommeil d'origine obstructive, a subi une réparation ORL. L'ouverture de sa bouche était d'à peine 25 mm. La ventilation par masque a été facile. La laryngoscopie directe a échoué après l'induction de l'anesthésie et le blocage neuromusculaire. Ni le MLI 5, ni le 4 n'ont pu être insérés entre les dents du patient en dépit de différentes manœuvres de torsion. Le ML 4 a alors été préparé comme un tube pour l'intubation fibroscopique. La mise en place du ML et l'intubation avec guidage fibroscopique ont été faciles. Le ML a été retiré du tube trachéale (TT) pour permettre l'intervention ORL qui s'est déroulée sans incident. L'examen manuel a d'abord montré, comparativement à d'autres du même type, que les MLI inefficaces n'étaient pas suffisamment compressibles pour permettre l'insertion ou mesuraient plus que les 20 mm reconnus comme la dimension extérieure maximale. L'examen radiologique a révélé qu'à la pointe de l'appareil, dans sa partie compressible, la couche de silicone était plus épaisse sur les dispositifs inefficaces à l'intubation que sur les autres MLI souples et que l'extrémité du tube d'acier comportait un biseau plus court.

Conclusion : Notre incapacité à insérer un MLI chez un patient dont l'ouverture de la bouche était à peine de 25 mm relevait du manque de compressibilité de l'appareil même si le fabricant assure que la dimension extérieure maximale est de 20 mm.

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WHEN the laryngeal mask airway (LMA) was introduced for the management of the difficult airway, it proved to be useful to facilitate tracheal intubation acting as a conduit for oral placement of the fiberoptic bronchoscope prior to railroading of the tracheal tube (TT).¹ However, its construction imposed length/diameter limitations on the TTs that could be passed through it.^{1,2} The intubating laryngeal mask airway (ILMA), introduced in 1997, overcomes the length/diameter limitations of the LMA and optimizes the angle at which the trachea is intubated.³⁻⁵ The ILMA, like the LMA, ought to be usable in certain patients with limited mouth opening, as it is described as having a maximum outer dimension of 20 mm.⁴ We report a case in which it proved impossible to insert #4 and #5 ILMAs in a patient with a mouth opening of just under 25 mm.

Case report

A 53-yr-old healthy man, height 170 cm, weight 80 kg, presented with obstructive sleep apnea. He was given a general anesthetic for elective uvulo-palato-pharyngoplasty. The patient was classified ASA II, and Mallampati II.⁶ He had a mouth opening of 24.5 mm, and he denied any history of difficult intubation. His last previous anesthetic procedure, general anesthesia five years earlier, was uneventful.

After premedication with 7.5 mg midazolam *po*, anesthesia was induced with 2 mg·kg⁻¹ propofol *iv*, 2 mg midazolam *iv* followed by 1.5 mg·hr⁻¹ remifentanyl and 200 mg·hr⁻¹ propofol *iv*. Bag-mask-valve ventilation was established and neuromuscular block was achieved with 0.2 mg·kg⁻¹ mivacurium. Direct laryngoscopy failed because of the combination of limited mouth opening and a high anterior larynx: BURP⁷ did not improve the laryngoscopic view. The patient's lungs were gently ventilated by mask, and we called for the portable storage unit for difficult airway management. As ventilation by mask was easy and the patient was not at increased risk of aspiration of gastric contents,⁸ we decided to perform tracheal intubation via an appropriately sized ILMA. However, it proved impossible to insert either a #5 or a #4 ILMA (LMA-Fastrach™, The Laryngeal Mask Company Ltd., Henley on Thames, Oxon, UK.), because neither could be passed between the patient's teeth, despite twisting maneuvers. A #4 LMA was prepared as a conduit for fiberoptic intubation in the manner described by Benumof.¹ Placement of the LMA with the tracheal tube (TT) inside was very easy despite the patient's limited mouth opening. Subsequent fiberoptic-guided intubation via the #4 LMA was easily per-

formed. The LMA was then removed over the TT to enable the surgery to proceed. The remainder of the intraoperative course was uneventful.

Discussion

The LMA was developed as an alternative to the face mask for ventilation and has proved to be highly successful as a device for guided intubation. Ease of insertion and its proved value in situations of difficult airway suggested that the device might be useful for emergency airway management. In fact, the multiplicity of uses for the LMA within the existing "ASA Difficult Airway Algorithm" has been clearly described.¹ However, its usefulness as an intubation guide is limited because the LMA airway tube is too narrow to accommodate a standard size TT and too long to ensure that the TT cuff, on advancing into the larynx, does not come to rest between the vocal cords.^{1,2} The ILMA overcomes these limitations. With a short, wide-bore, silicone-sheathed stainless steel tube, this device can accommodate an 8.0 mm TT.⁴ The maximum outer diameter (OD) of the ILMA (defined as being "in the plane of the curvature of the tube at the point where it is overlapped by the proximal part of the cuff" is stated to be 20 mm.⁴ Thus, it should be possible to insert the device if the interdental distance is ≥ 20 mm.³⁻⁵ Nonetheless, we were unable to insert the device in a patient with an interdental gap of 24.5 mm.

When it proved impossible to insert either a #5 or a #4 ILMA into the mouth of the patient, we returned to a former strategy using the standard LMA. First, it is known that the LMA can be inserted even when the mouth opening is as small as 12 mm.⁸ Secondly, the device is recommended as a conduit for fiberoptic intubation in cases of difficult airway,¹ and subsequent removal of the LMA over the TT is easily accomplished.⁹

In a recent clinical report, Asai *et al.*¹⁰ demonstrated successful awake placement of an adult-sized ILMA in a patient with a limited mouth opening of 20 mm. They were able to insert the mask by rotating it to the side when passing it behind the upper teeth.¹¹ While Brimacombe *et al.*¹² have cautioned against use of the ILMA when mouth opening is so limited, we feel that the advantages of the ILMA are such that, should the anesthesiologist consider the circumstances appropriate, intubation via the ILMA should be attempted. The one proviso would be that the LMA be available for immediate use, in the manner described by Benumof.¹

Our experience in this case led us to examine the ILMAs which we had attempted to insert. We found that the maximum compressed OD of the ILMAs was 26.2 mm in the #4 mask and 28.3 mm in the #5 mask. It should be noted that the steel tube ends in this part

FIGURE 1 In both Figure 1.1. and Figure 1.2 the ILMA marked A is compressible to 20 mm. The ILMA marked B is far less compressible.

FIGURE 1.2 note more pronounced angle of bevel in ILMA A compared to ILMA B (arrows) and thicker application of silicone below end of steel tube in ILMA B compared with ILMA A.

of the mask. The end of the tube is described as being beveled 30° anteriorly at this point specifically to permit compression of the silicone for patients with limited mouth opening.⁴ We also found that ILMAs ordered and stocked earlier by another division of our department were compressible to 20 mm at the maximum OD. These masks had a different lot number

series from ours. An examination of the 16 ILMAs in our supplies revealed that nine were compressible to 20 mm at the maximum OD. Gross inspection yielded no explanation for our findings. Thus, we took X-rays of the ILMAs we had unsuccessfully attempted to use and of those we were able to compress and found that there appears to be a much thicker layer of silicone in the former than in the latter and that the bevel at the end of the steel tube was much shallower in the former, thus creating a hindrance to compressibility (Figure 1). Similar results were found with thin section spiral computed tomography, using a high resolution window-level setting.

In conclusion, our inability to insert an ILMA in a patient with an interdental distance of just under 25 mm was because the device was not compressible to less than that distance even though the maximum OD is reported as 20 mm. ILMAs should be checked for compressibility before use in patients with limited mouth opening. Standard LMAs may, under certain circumstances, be more successful than ILMAs in such patients.

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