Journal of Anesthesia & Clinical Research

Sanuki et al. J Anesthe Clinic Res 2011, 2:7
DOI: 10.4172/2155-6148.1000147

Research Article Open Access

Comparison of Metal Stylet, Small Tracheal Tube and Combined Introducer-Aided Insertions of the Flexible Reinforced Laryngeal Mask Airway with the Conventional Method: a Manikin Study

Takuro Sanuki[1]*, Hiroki Son[2], Shingo Sugioka[1], Naoe Komi[1], Motoko Hirokane[1], Naotaka Kishimoto[1], Yoshiko Mastuda[1] and Junichiro Kotani[1]

[1]*Department of Anesthesiology, Osaka Dental University, Osaka, Japan*

[2]*Department of Dentistry, Seisyukai Clinic, Osaka, Japan*

Abstract

Purpose: The present study compared the conventional method (without any adjunct) and three different adjunct-aided methods (a metal stylet, a small tracheal tube, and a combined introducer) with regard to the time required for insertion of the flexible reinforced laryngeal mask airway (FLMA). We also surveyed participants' views on the ease of FLMA insertion with each method.

Methods: Thirty dental students inserted the FLMA in a manikin by each method and the times required for insertion were measured. Subjects were asked to rate the ease of insertion with each method using a 100-mm visual analogue scale (VAS; from 0 mm = extremely easy to 100 mm = extremely difficult).

Results: Insertion time was significantly shorter with the small tracheal tube compared with the conventional method. However, insertion times with the metal stylet-aided insertion and the combined introducer-aided insertion were not significantly different as compared to the conventional method. With regard to the ease of insertion as rated using the 100-mm VAS, the dental students rated tracheal tube-aided insertion and combined introducer-aided insertion as being significantly easier, and the metal stylet-aided insertion as significantly more difficult than the conventional method.

Conclusions: The small tracheal tube-aided insertion and the combined introducer-aided insertion each appear to possess advantages over the conventional method. The small tracheal tube-aided insertion seems overall more favorable in terms of ease and time to insertion.

Keywords: Adjunct; Airway management; Reinforced laryngeal mask airway

Abbreviations: FLMA: Flexible reinforced LMA; LMA: Laryngeal Mask Airway

Introduction

In recent years, the laryngeal mask airway (LMA) has become increasingly popular in general anesthesia [1-3]. The flexible reinforced LMA (FLMA) is an extremely useful LMA, especially during oral surgery and dental procedures, as it does not interfere with the surgical field and is resistant to kinking and compression. However, its insertion and correct placement can be difficult, owing to the floppy flexometallic shaft, whereby the force is not easily transmitted along the shaft [4,5]. Hence, many adjuncts such as a metal stylet [6], a small tracheal tube [7] and a combined introducer [8] have been described to facilitate the insertion of the FLMA. However, the utility of these adjunct-assisted methods have yet to be compared. Thus, we compared the conventional method (without any adjunct) and three different methods using adjuncts (a metal stylet, a small tracheal tube, and a combined introducer) with regard to the time required for and success rates of insertion of the FLMA. We also surveyed participants' views on ease of FLMA insertion by each method.

Methods

As advised by the local research ethics committee, since this volunteer, laboratory-based study did not involve patients, it did not require formal committee approval. Thirty fifth-year dental students (age, 23.2±0.9 years; sex (female/male), 20/10) from a 6-year, undergraduate dental program, who had never seen or used a FLMA were randomly recruited and tested at their convenience. Informed consent was obtained from all subjects participating in this study. Data were recorded anonymously and information on the performance of individual participants was not made available to anyone outside of the study group.

One of the authors (T.S.) demonstrated how to insert the size 4 FLMA (Laryngeal Mask Company, Jersey, UK) using the technique originally described by Brain [9], which is the technique recommended by the manufacturer as well. For the metal stylet-aided insertion [6], a metal stylet was passed into the FLMA. The length of the metal stylet was adjusted so that the distal end did not protrude through the grill of the FLMA (Figure 1). For the small tracheal tube-aided insertion [7], an ID 5-mm tracheal tube was cut to a length of 24 cm and the cut tracheal tube was inserted into the size 4 FLMA (Figure 2A). The distal end of the tracheal tube just fit the FLMA, so that it was positioned near the grill of the FLMA (Figure 2B). For the combined introducer [8], the

***Corresponding author:** Dr.Takuro Sanuki, Department of Anesthesiology, Osaka Dental University, 1-5-17 Otemae, Chuo-ku, Osaka 540-0008, Japan, Tel: +81-6-6910-1031; Fax: +81-6-6910-1032; **E-mail**: odu9847@ yahoo.co.jp

Received May 16, 2011; **Accepted** June 20, 2011; **Published** July 03, 2011

Citation: Sanuki T, Son H, Sugioka S, Komi N, Hirokane M, etal. (2011) Comparison of Metal Stylet, Small Tracheal Tube and Combined Introducer-Aided Insertions of the Flexible Reinforced Laryngeal Mask Airway with the Conventional Method: a Manikin Study. J Anesthe Clinic Res 2:147. doi:10.4172/2155-6148.1000147

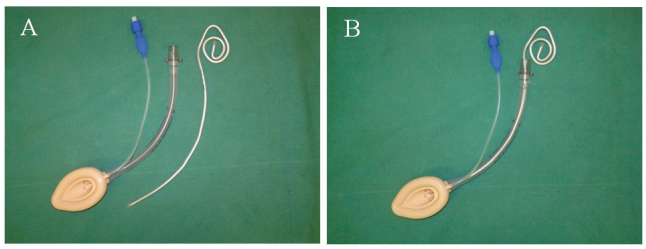

Figure 1: A: Armamentarium for metal stylet-aided insertion. B: FLMA with metal stylet in it

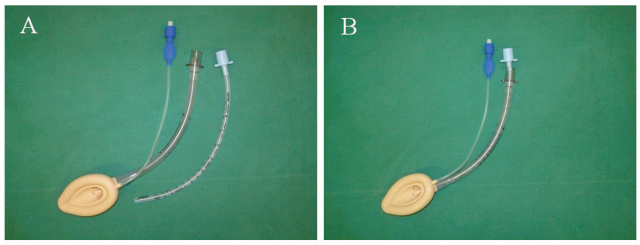

Figure 2: A: Armamentarium for small tracheal tube-aided insertion. B: FLMA with tracheal tube in it.

same metal stylet and tracheal tube as for the metal stylet-aided and small tracheal tube-aided insertions were used (Figure 3). Participants were allowed to practice insertion of the FLMA on a manikin (Airway management trainer, Laerdal, Stavanger, Norway) using each method once. Next, they performed a timed insertion of the FLMA using each method once, in random order.

Primary measurements comprised the time required for and the rates of successful FLMA insertion. Insertion time was recorded from the time of taking hold of the FLMA with adjunct to lung inflation of the manikin after connecting the FLMA to a self-inflating bag. The cuffs of the FLMAs were inflated with 15 ml of air before connecting to the ventilation bag. A successful insertion attempt was defined as an attempt in which adequate lung inflation of the manikin was observed. If participants were unable to insert the FLMA in the first attempt, it was recorded as an unsuccessful attempt. Finally, immediately after insertions by the four methods, participants were asked to rate the ease of insertion of each method using a 100-mm visual analogue scale (VAS; from 0 mm = extremely easy to 100 mm = extremely difficult).

Prior to this study, a pilot study on the measurement of insertion time was conducted, which also enabled calculation of the sample size required for this study. Insertion times in the pilot study were 28.8 s for the conventional method and 26.0 s for the small tracheal tube-aided insertion, with a standard deviation (SD) of 5.0 s for both methods. Power analysis suggested that a minimum of 28 participants would be needed for β=0.2; α=0.05. Hence, 30 participants were enrolled in this study in order to allow for any methodological difficulties that could lead to exclusion from the study. Non-repeated measures ANOVA was used to analyze insertion time and the Dunnett's test was used for multiple comparisons. Rates of successful insertions were analyzed using Yates χ^2 test. The Kruskal Wallis H-test was used to analyze the VAS and the Mann-Whitney U-test with Bonferroni correction was used for multiple comparisons.

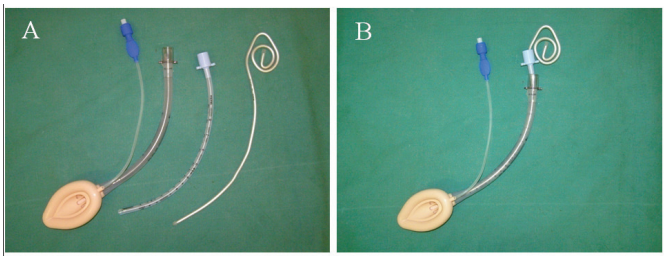

Figure 3: A: Armamentarium for combined introducer-aided insertion. B: FLMA with metal stylet and tracheal tube in it.

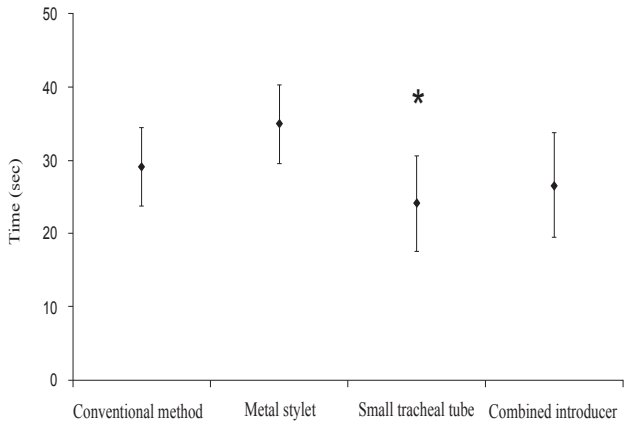

Figure 4: Insertion times with the different FLMA insertion adjuncts. Data represent mean ± standard deviation. *: P <0.05 versus conventional method.

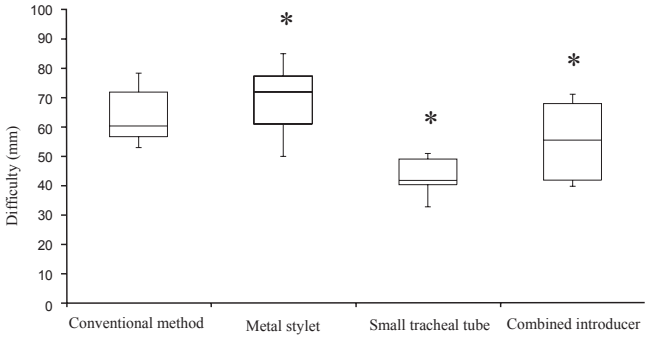

Figure 5: Ease of insertion with the different FLMA insertion adjuncts. Data are presented as percentiles (90th, 75th, 50th, 25th, and 10th). *: P<0.05 versus conventional method.

Results

All 30 dental students completed the study. Insertion time was significantly shorter with the tracheal tube-assisted method (24.2 ±6.4 s; *P*=0.032) as compared to the conventional method (29.1 ±5.4 s) (Figure 4). However, insertion times with the metal stylet-aided (34.9 ±5.4 s; *P*=0.756) and combined introducer-aided methods (26.6 ±7.1 s; *P*=0.425) were not significantly different from those with the conventional method (Figure 4).The rates of successful insertions using the metal style-aided insertion (22 of 30 attempts; 73.3%), the

small tracheal tube-aided insertion (28 of 30 attempts; 93.3%) and the combined introducer-aided insertion (26 of 30 attempts; 86.7%) were greater than that obtained using the conventional method (21 of 30 attempts; 70.0%), although the differences were not statistically significant (P=0.158). With regard to the ease of FLMA insertion as rated using the 100-mm VAS, the dental students rated the tracheal tube-aided insertion (median, 42 mm [10th-90th percentile, 32-52 mm]; P<0.001) and the combined introducer-aided insertion (54 [40-69] mm; P=0.002) as significantly easier to perform, and the metal stylet-aided insertion (77 [50-92] mm; P=0.003) as significantly more difficult to perform than the conventional method (64 [53-78] mm) (Figure 5).

Discussion

The FLMA has become established as an acceptable alternative to tracheal intubation for oral surgeries and dental procedures, as it does not interfere with the surgical field and is resistant to kinking and compression. However, its insertion and correct placement can be difficult, owing to the floppy flexometallic shaft, as the force is not easily transmitted along the shaft [4,5]. A previous study by George and Sanders [10] showed that the FLMA was significantly more difficult to insert than the standard LMA; in their study, ease of insertion was graded as easy in 37/40 patients (93%) with the standard LMA as compared to 28/39 (72%) with the FLMA. The number of attempts for successful LMA insertion in this previous study was also significantly higher with the FLMA (1.3±0.6) as compared to the standard LMA (1.0±0.2). Therefore, many adjuncts such as a metal stylet, a small tracheal tube and a combined introducer have been described to facilitate insertion of the FLMA.

Our results show that in a manikin, use of the small tracheal tube-aided method can achieve adequate FLMA placement more quickly and with greater ease than insertion by the conventional method. There were no significant differences, however, in the insertion time between metal stylet-aided insertion and the conventional method, although insertion by this method was rated as being more difficult than the conventional method. In the case of the combined introducer aided insertion, since insertion was rated as being easier than the conventional method but time to insertion was not shorter, we suspect that with this method, removal of the introducer after insertion of the FLMA was difficult because the introducer fit snugly into the FLMA. These results suggest that the small tracheal tube-aided insertion and the combined introducer-aided insertion each appear to possess advantages over the conventional method, with the small tracheal tube-aided insertion being most advantageous. In contrast, the participants rated the metal stylet-aided insertion as more difficult to insert than the conventional method. We suspect that the metal stylet-aided insertion is difficult to perform because the FLMA can rotate along the axis of the metal stylet. The rates of successful insertion using the small tracheal tube and the combined introducer were substantially greater than that with the conventional method, although the difference was not statistically significant. A larger study would be needed to determine whether this is actually the case.

The present study includes a number of limitations. First, all insertion attempts were performed by inexperienced users. Our results may not be applicable to experienced users. Second, the cuff position of the FLMA was not assessed. Third, all insertions were performed on a manikin. Although the use of a manikin does not fully reproduce airway conditions in patients, it is a popular approach to evaluate and compare various airway devices, at least in part for ethical reasons [11,12]. Fourth, our study lacked blindness. In this study, blinding was unrealistic because the specific adjunct was difficult to hide, both from the investigator who measured insertion times and from the subject attempting the insertion. Nevertheless, the measured variables in this study (insertion times and number of successful insertions) were clearly defined. Thus, we consider that the lack of blindness is unlikely to have skewed our results. Moreover, previous studies concerning airway devices have been designed in an unblinded fashion [11,12].

In conclusion, the small tracheal tube-aided insertion and the combined introducer-aided insertion each appear to possess advantages over the conventional method. Therefore, when insertion of the FLMA using the conventional method is likely to be difficult, selection of methods using the small tracheal tube and the combined introducer is probably an easy solution to this insertion problem. The small tracheal tube-aided insertion possesses advantages over both the conventional and combined introducer-aided insertion methods.

Acknowledgments

The authors thank Dr Rumiko Uda (Department of Anesthesia, Hirakata City Hospital) for her valuable comments. This work was supported by the Department of Anesthesiology, Osaka Dental University, Osaka, Japan.

References

1. Sanuki T, Sugioka S, Hirokane M, Son H, Uda R, et al. (2010) The influence of mouth opening on oropharyngeal leak pressure, intracuff pressure and cuff position with the laryngeal mask airway. J Oral Maxillofac Surg 68: 1038-1042.
2. Sanuki T, Sugioka S, Hirokane M, Son H, Uda R, et al. (2011) Optimal degree of mouth opening for laryngeal mask airway function during oral surgery. J Oral Maxillofac Surg 69: 1018-1022.
3. Sanuki T, Sugioka S, Son H, Uda R, Akatsuka M, et al. (2011) Effects of head-neck extension on abnormality of laryngeal mask airway function resulting from opening the mouth. J Oral Maxillofac Surg 69: 1311-1315.
4. Sanuki T, Nakatani G, Sugioka S, Daigo E, Kotani J (2011) Comparison of the Ambu® AuraFlex™ with the laryngeal mask airway Flexible™: A manikin study. J Oral Maxillofac Surg [Epub ahead of print].
5. Chakravarty A, Wadhawan S (2009) A novel technique of flexible reinforced laryngeal mask airway insertion. Anaesth Intensive Care 37: 669-670.
6. Brimacombe J, Berry A (1993) Stylet for reinforced laryngeal mask airway. Anaesthesia 48: 637.
7. Asai T, Stacey M, Barclay K (1993) Stylet for reinforced laryngeal mask airway. Anaesthesia 48: 636.
8. Maino P, Pilkington M, Popat M (1998) Combined introducer for reinforced laryngeal mask airway. Anaesthesia 53: 91-92.
9. Brain AI (1983) The laryngeal mask – a new concept in airway management. Br J Anaesth 55: 801-805.
10. George JM, Sanders GM (1999) The reinforced laryngeal mask in paediatric outpatient dental surgery. Anaesthesia 54: 546-551.
11. Miki T, Inagawa G, Kikuchi T, Koyama Y, Goto T (2007) Evaluation of the Airway Scope, a new video laryngoscope, in tracheal intubation by naive operators: a manikin study. Acta Anaesthesiol Scand 51: 1378-1381.
12. Koyama Y, Inagawa G, Miyashita T, Kikuchi T, Miura N, et al. (2007) Comparison of the Airway Scope, gum elastic bougie and fibreoptic bronchoscope in simulated difficult tracheal intubation: a manikin study. Anaesthesia 62: 936-939.