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A Comparison Of Two Laryngeal Masks As A Conduit For Fiberoptic Tube Exchange

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Summary

Endotracheal intubation remains the gold standard for many surgical procedures; however, since the 1996 revision of the 1993 ASA Practice Guidelines for the Management of Difficult Airway including the laryngeal mask airway as a rescue device, there is an increasing need to exchange the laryngeal mask airway for an Endotracheal tube (ETT) after failed direct laryngoscopy (DL)[1].

The present study evaluated the use of two supralaryngeal airway devices (AuraOnce, AO, Ambu A/S, Denmark; and LMA-Unique, uLMA, North America, San Diego, CA) as conduits for tracheal intubation using the Aintree Intubation Catheter® (AIC) (Cook Critical Care, Bloomington, IN).

The data demonstrates that both devices can be used for this purpose; however, the AO performed significantly better than the uLMA in terms of leak pressure and postoperative complications and demonstrated a tendency of better performance in terms of time of insertion and intubation. This investigation suggests that supralaryngeal airway devices can easily be exchanged by ETTs via the AIC.

Introduction

Securing the airway with an ETT continues to be the gold standard for many surgical procedures, especially when gastric content aspiration and airway dislocation is of concern. Standard direct laryngoscopy is the usual method to perform orotracheal intubation, yet this procedure is reported to difficult as frequently as 10% in the general population and 20% in specific populations, such as morbid obesity and obstetric patients[2]. Difficult mask ventilation may occur during attempts of endotracheal intubation and since supralaryngeal devices have been successfully used to provide adequate ventilation, their use can and should be considered in these situations.

Supralaryngeal devices are well designed to ventilate patients, even for prolonged surgical procedures. They can also be used in situations where endotracheal intubation is required. The laryngeal mask airway has become an integral part of difficult airway management[3]. With a greater use of the laryngeal mask airway as a rescue device for failed laryngoscopic intubation, an increased need exists for exchanging the laryngeal mask airway for an ETT.

One of the more recently developed techniques of rescue intubation is using the AIC technique, in which the combination of a supralaryngeal airway device and a fiberoptic bronchoscope (FOB) is used to facilitate endotracheal intubation via the exchange catheter. Even in a situation of planned awake fiberoptic intubation with poor patient cooperation, either because patient anxiety or mental dysfunction, the AIC technique can have great advantages[4].

Intubation through the laryngeal mask airway using the AIC technique is achieved by placing a flexible fiberoptic bronchoscope through the exchange catheter and then both the catheter and fiberscope are directed through the shaft of the supralaryngeal airway[5]. The laryngeal mask airway is then removed and an ETT (> 7.0mm) is guided over the exchange catheter.

The Classic Laryngeal Mask Airway (cLMA) was the first "modern" supralaryngeal airway device introduced into clinical practice in the 1980's by Dr. Archie Brain[6]. A supralaryngeal airway device is not intended to pass the vocal cords; rather it is inserted through the oropharynx and is placed just proximal to the laryngeal inlet. Unlike an ETT, these devices create a seal around the larynx and permit the oxygenated gases to be delivered to a patient during general anesthesia from a position above the glottis. The disposable version of the cLMA, the uLMA, was introduced into clinical practice in 1998.

The Ambu® Single Use Laryngeal Mask, AO™ (AMBU A/S, Denmark) was introduced in 2004. Similar to both the cLMA and uLMA, the AuraOnce is available in pediatric and adult sizes (Fig. 1). The device consists of 3 key elements: an airway tube, a mount member, and a cuff. All 3 elements are moulded together in one piece to minimize the risk of separation of the device. The AuraOnce™ has a preformed anatomical curvature which has shown advantages regarding ease of insertion and clinical performance as an intubation conduit[5,7,8]. The cuff is thin and contoured to fit the hypopharynx so that, when properly positioned, the distal tip of the cuff sits in the upper esophageal sphincter and the proximal end rests at the base of the tongue. The bowl of the mask is open (with no aperture bars) and faces the glottis.

The aim of the present study was to compare the uLMA and the AuraOnce™ (AO) as intubation conduits using fiberoptic guided AIC[5].

Figure 1. AuraOnce Ambu A/S

Methods

Following approval by the Institutional Review Board and written informed consent, 50 patients were recruited to participate in this study. Written and oral information was provided to the participant, and written informed consent was obtained. Patients evaluated as ASA I-III and Mallampati I-III scheduled for elective surgery under general anesthesia were recruited. Anesthesia was induced with intravenous propofol (2mg/kg) and fentanyl (1-2_g/kg). After verbal instruction, resident anesthesiologists performed all airway procedures. Following successful insertion of either laryngeal mask airway (AO n=25; uLMA n=25), intracuff pressures were adjusted to 60 cmH_20, and a leak test was performed. Using a FOB, the AIC was guided through the laryngeal mask airway and positioned above the carina. The FOB was

then removed from the AIC, followed by removal of the laryngeal mask airway, leaving the AIC in place. An ETT was guided over the AIC using direct laryngoscopy to ensure proper placement. Time to insert the laryngeal mask (entering oropharynx until the first capnograph breath), the AIC (FOB enters laryngeal mask airway to placement above carina), and the ETT (laryngoscope enters oropharynx until first capnograph breath) were recorded. Ease of exchange (# of attempts), leak pressure, intraoperative complications (laryngospasm, blood, coughing, etc.), and airway morbidities at 2 and 24 hours postoperatively (sore throat, hoarseness, odynophagia, etc.) were also documented.

Results

Although all patients were randomized to receive either an AO or an uLMA, the distribution of males to females was different resulting in a significant difference in height and weight between the 2 groups (Table 1).

The AO performed significantly better compared to the cLMA with respect to adequate ventilation and leak pressures. The AO showed an average ventilation leak pressure of 25.4±5.00 cmH20 while the uLMA exhibited an average leak pressure of 20.3 ± 6.65 cmH20 (p=0.004). The average insertion time of AO was 20.0 ± 8.61 seconds and for uLMA 25.1 ± 13.57 seconds. The AIC-ETT exchange time recorded was 31.9 ± 28.81 seconds for AO and 41.5 ± 25.60 seconds for the uLMA. While these differences are not significant (p=0.225), the data suggest that the AO might be easier to insert and that the AIC may be more easily placed in the AO as compared to uLMA. There were no placement failures and all airways were secured by an ETT within 2 attempts, at maximum. In general, a higher incidence of postoperative complications was reported in the uLMA group. There were more cases of hoarseness reported at 2 hours postoperatively for the uLMA group as compared to the AO (p=0.04).

Table 1

	LMA-Unique (n=25)	AuraOnce (n=25)
Male:Female (n)	13:12	17:8
Height (cm)*	167.4±9.72(150-188)	174.0±10.90 (147-93.04)
Weight (kg) *	70.8±13.41(50-100)	80.1±16.29 (41.5-111.36)
LM # of attempts 1:2.f (n)	24:1:0	22:3:0
LM insertion time (s)	25.1±13.57 (12-65)	20.0±8.61 (11-53)
Leak pressure (mmHg) *	20.3±6.65 (12-32)	25.4±5.00 (14-36)
AIC # of attempts 1:2:3:f (n)	24:1:0:0	22:1:1:1
AIC insertion time (s)	41.5±25.6 (12-102)	31.9±28.81 (6-148)
ET insertion time (s)	32.9±14.28 (12-53)	27.7±14.61 (9-60)
Complications	**None:Mild:Mod:Severe (n)**	
2 hr sore throat (n)	14:9:2:0	18:3:4:0
24 hr	19:5:1:0	20:4:0:1
2 hr hoarseness*	13:9:3:0	20:4:1:0
24 hr	19:6:0:0	23:1:1:0
2 hr dysphagia	13:10:2:0	19:4:2:0
24 hr	22:3:0:0	22:2:1:0

*p<0.05

Discussion

When securing the airway during a difficult airway situation, the pressure at which the patient can be ventilated before the mask leaks (leak pressure) is clinically important. This study demonstrates that the AO performs significantly better regarding adequate ventilation with a higher leak pressure values, as compared to the uLMA. Higher leak pressures are beneficial for ventilation and this can be important during management of the airway prior to the exchange for an ETT, especially in a situation of a difficult airway. The time to insert the supralaryngeal airway device, as well as the time for the first capnograph breath to appear, is also very crucial. As previously shown by Hagberg et al,[7] this study indicates that AO time of insertion is shorter than uLMA (20.0 ± 8.61 seconds vs 25.1 ± 13.57 seconds, respectively).

The time required to place the AO for successful ventilation and to exchange for an ETT were also shorter with AO as compared to uLMA.

Lastly, the insertion time for the AIC indicates the same tendency for being shorter regarding the AO as compared to the uLMA (31.9 ± 28.81 seconds vs 41.5 ± 25.60 seconds, respectively). The present study indicates fewer complications observed with the AO. The Ambu AuraOnce can be used as a means of intubation following difficult or failed laryngoscopy/intubation attempts.

Conclusions

Supralaryngeal airway devices serve as excellent conduits for fiberoptic guided intubation and airway exchange to an endotracheal tube. This technique is safe, effective, and easy to perform. This study demonstrates that higher airway seals were achieved with the Ambu AuraOnce as compared to the LMA-Unique, which can be beneficial for ventilation prior to the exchange, especially following failed endotracheal intubation.

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