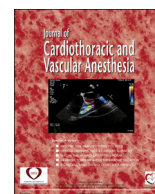




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Original Article

Can Transesophageal Echocardiography Be Performed Safely Using a Laryngeal Mask Airway During Atrial Fibrillation Ablation?

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Objective: To investigate the feasibility and safety of using a laryngeal mask airway (LMA) compared with a cuffed oral endotracheal tube (COETT) for atrial fibrillation (AF) ablation with transesophageal echocardiography (TEE).

Design: Prospective, cohort study.

Setting: A single-center inner-city hospital.

Participants: The study comprised adult patients undergoing elective AF ablation with periprocedural TEE over a 3-year period.

Interventions: Patients were treated with either an LMA or a COETT before undergoing a standardized protocol for TEE and AF ablation.

Measurements and Main Results: The primary outcome was the need for conversion from an LMA to a COETT. Between January 2014 and January 2017, 346 patients underwent AF ablation. Of those, 126 procedures were performed with a COETT (36.4%) and 220 (63.6%) with an LMA. There were no differences between groups in terms of baseline characteristics, including age, sex, body mass index, and American Society of Anesthesiologists grade. An adequate airway seal was unable to be maintained in 3 patients in the LMA group (1.4%), and those patients were converted to a COETT. No episodes of airway complications occurred in either group. No difference was found in mean propofol (2%) dose between COETT and LMA (385 mg/h v 374 mg/h; $p = 0.127$). However, the mean remifentanyl dose (100 µg/mL) was reduced significantly in the LMA group compared with the COETT group at 355 µg/h and 939 µg/h, respectively ($p < 0.001$).

Conclusions: LMA use is safe and feasible in the vast majority of patients undergoing AF ablation with TEE and is an acceptable alternative to COETT. A significantly reduced rate of remifentanyl was required to maintain anesthesia in the LMA group.

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Key Words: ablation; echocardiography; laryngeal mask airway

ATRIAL FIBRILLATION (AF) is the most common arrhythmia in clinical practice, with a prevalence of approximately 2.5% in the general population.¹ The primary indication for AF ablation is the presence of symptomatic AF

resistant to antiarrhythmic therapy. Due to the length of the procedure, potentially painful stimuli, and the need to remain motionless throughout, deep sedation or general anesthesia (GA) is used commonly.^{2,3} A survey of a task force convened to provide an expert consensus of AF ablation found that 50% of members performed ablation with the patient under GA.⁴ Several studies have compared the use of a cuffed oral endotracheal tube (COETT) and a laryngeal mask airway (LMA) in GA in terms of control of ventilation, hemodynamic

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profile, anesthetic requirement, and complications such as endotracheal trauma.⁵⁻⁸ LMA use has been shown to be associated with several benefits over COETT, including speed and ease of placement, reduced anesthetic requirement for airway tolerance, and reduced incidence of postoperative sore throat.⁹ Despite these advantages, COETT traditionally has been favored for AF ablation because it allows for the placement of a transesophageal echocardiography (TEE) probe, which usually is considered a contraindication to LMA use. The advantages of TEE in AF ablation include screening for left atrial thrombus before ablation, estimating the left atrial size, and guiding catheter placement either in conjunction with or in place of fluoroscopy.^{10,11} TEE also can help in the early diagnosis of procedural complications such as pericardial effusion.¹²

In recent years, the standard of care in the authors' center changed from using a COETT to maintain the patient's airway during AF ablation to using an LMA. This change initially was triggered by a specific patient request to avoid tracheal intubation if at all possible. This patient was an opera singer and as such wanted to minimize the risk of vocal cord injury. Having performed this specific procedure using an LMA with relative ease, the potential benefits led the authors to incorporate this change into routine clinical practice. In this prospective cohort study, the authors document the process of changing their practice to the routine use of LMA and TEE for AF ablation. A comparative analysis between the two airways was performed with the aim of demonstrating the feasibility, safety, and efficacy of LMA use.

Methods

Data were collected prospectively on all patients undergoing percutaneous AF ablation at a single institution over a 3-year period as part of an internal audit process. TEE and ablation were performed in a single episode of care in the catheter laboratory with all patients treated by a single anesthesiologist (B.O.B.) and a single cardiologist (R.S.). Exclusion criteria for LMA use were a previous history of failed LMA use, severe gastroesophageal reflux disease, and pharyngeal anatomy precluding LMA use (congenital, postsurgical anatomic variation).

All patients were anesthetized using a total intravenous anesthesia protocol of propofol bolus (2-3 mg/kg) and remifentanyl (0.5 µg/kg). Patients treated with COETT also received neuromuscular blockade (NMB) with rocuronium (0.5 mg/kg). For COETT cases, a TEE probe (Portex; Smith Medical, Minneapolis, MN) was inserted under direct vision during laryngoscopy just before endotracheal intubation. For LMA cases, the TEE probe also was placed under direct vision with limited laryngoscopy (tongue retraction) to ensure correct placement and minimize the risk of trauma from blind insertion. After placement of the TEE probe, either an i-gel (Intersurgical, Berkshire, UK) or an LMA Supreme (Teleflex, Wayne, PA) was inserted using a 2-person technique to provide a jaw thrust during placement. Both the COETT and LMA were secured with tape in a central position. Anesthesia

was maintained with continuous infusions of propofol (target rate 4 mg/kg/h) and remifentanyl (target rate 2-3 µg/kg/h). All patients were mechanically ventilated with oxygen and air for the duration of the procedure. Induction and maintenance doses of propofol and remifentanyl were adjusted according to patient factors, stages of the procedure, and signs of depth of anesthesia.

Once inserted, TEE was used to check for atrial thrombus before commencement of the ablation and to guide transseptal puncture and catheter placement. It then was withdrawn before the ablation to minimize apposition of the esophagus and the left atrium. Manipulation of TEE in all planes was performed with both airway types. However, transgastric views were not performed routinely because they are not required for AF ablation.

Patients underwent AF ablation using either radiofrequency energy or cryotherapy. In either case, the phrenic nerve was paced routinely during ablation of the right pulmonary veins to check for impending phrenic nerve injury by simultaneously palpating for diaphragmatic contraction and observing the capnography trace.

Patients were grouped by use of either COETT or LMA, and a comparative analysis was performed. The primary outcome in determining the feasibility of performing ablation using an LMA was measured in terms of the number of patients who required conversion to COETT. Secondary end points included procedure duration, quantities of anesthetic agents used to maintain anesthesia, and the development of airway-related complications. These were defined as intraoperative desaturation episodes (peripheral capillary oxygen saturation < 95%), oropharyngeal or dental injury, aspiration of gastric contents, esophageal or tracheal perforation, laryngospasm, and vocal cord damage.

Statistical analysis was performed with SPSS, Version 22 (IBM Corp, Armonk, NY). Categorical variables were compared with the chi-square test. Continuous variables were tested for normality with the Shapiro-Wilks test and analyzed with either the Student *t* test (normally distributed variables) or the Mann-Whitney *U* test (non-normally distributed variables).

The change in use from COETT to LMA represented a process of evolving best practice using CE-marked airway devices in their approved manner without any element of randomization. Because the evaluation was considered to be an audit of established clinical practices, specific institutional ethics committee approval was deemed unnecessary. All patient-identifiable data were removed before analysis.

Results

Between January 2014 and January 2017, 346 patients underwent AF ablation with TEE support. An additional 5 patients had incomplete records and were excluded from analysis. Of the 346 patients, 126 procedures were performed with COETT (36.4%) and 220 (63.6%) with LMA. In the LMA group, 26 patients (11.8%) were treated with i-gel and 194 (88.2%) with LMA Supreme. All but 1 patient who had a COETT had their procedure performed in the first 15 months

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