Can J Anesth/J Can Anesth (2018) 65:543–550
https://doi.org/10.1007/s12630-018-1082-6

REPORTS OF ORIGINAL INVESTIGATIONS

Self-pressurized air-Q® intubating laryngeal airway *versus* the LMA® Classic™: a randomized clinical trial

Étude clinique randomisée du masque laryngé d'intubation *Self-pressurized air-Q®* versus le *LMA® Classic*^{MD}

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Received: 26 July 2016 / Revised: 22 December 2017 / Accepted: 28 December 2017 / Published online: 6 February 2018

Abstract

Purpose *The self-pressurized air-Q® (air-Q SP) intubating laryngeal airway is a relatively new supraglottic airway (SGA) device. The intracuff pressure of air-Q dynamically equilibrates with the airway pressure and adjusts to the patient's pharyngeal and periglottic anatomy, potentially providing improved airway fit and seal. The aim of this prospective randomized study was to compare the clinical performance of air-Q to the LMA® Classic™ SGA.*

Methods *Adult patients requiring general anesthesia for elective surgery were prospectively enrolled and randomly assigned to either air-Q SP or the LMA Classic SGA. Oropharyngeal leak pressure (primary endpoint), success rate, insertion features (insertion time, ease of insertion, requirement for device manipulation), sealing function, gastric insufflation, bronchoscopic view, and oropharyngeal complications at device insertion and following its removal (sore throat, dysphagia, dysphonia) were compared.*

Results *The mean (standard deviation [SD]) oropharyngeal leak pressure just after insertion was similar in the air-Q SP and LMA [16.8 (4.9) vs 18.6 (5.5) cm H_2O, respectively; mean difference, 1.8 cm H_2O; 95% CI, −0.5 to 4.2; P = 0.13] and did not differ at ten minutes following device insertion. Median [interquartile range (IQR)] peak inspiratory pressure just after insertion was lower in the air-Q SP (11.0 [10.0-13.0] vs 13.0 [11.0-14.0] cmH_2O, median difference, 1.0 cm H_2O; 95% CI, 0.0 to 2.0; P = 0.03) but no difference was observed at ten minutes. The median [IQR] insertion time was faster with the air-Q SP (15.9 [13.6-20.3] sec vs 24 [21.2-27.1] sec; median difference, 8.1 sec; 95% CI, 5.6 to 9.9; P < 0.001) and improved bronchoscopic viewing grade were seen with the air-Q SP immediately after insertion (P < 0.001). No differences between the groups were observed with respect to the rate of successful insertion at first attempt, overall insertion success rate, ease of insertion, and complications.*

Conclusions *The air-Q SP had similar leak pressures but a faster insertion time and superior bronchoscopic viewing grade when compared with the LMA Classic. The air-Q SP is a suitable alternative to the LMA Classic in adult patients and may be a superior conduit for tracheal intubation.*

Trial registration *www.clinicaltrials.gov (NCT02206438). Registered 1 August 2014.*

Résumé

Objectif *Le masque laryngé d'intubation Self-pressurized air-Q® (air-Q SP) est un dispositif pour voie respiratoire supraglottique (VRS) relativement nouveau. La pression à l'intérieur du coussinet de l'air-Q s'équilibre de façon dynamique avec la pression des voies respiratoires et s'adapte à l'anatomie pharyngée et périglottique du*

This manuscript has not been previously published elsewhere in any form except as an abstract/presentation at the European Society of Anesthesia meeting in May 2016.

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patient, procurant une meilleure étanchéité et un meilleur moulage aux voies aériennes. L'objectif de cette étude prospective randomisée était de comparer les performances cliniques de l'air-Q et du dispositif supraglottique LMA® Classic^{MD}.

Méthodes *Des adultes nécessitant une anesthésie générale pour chirurgie élective ont été recrutés de façon prospective et randomisés dans le groupe de dispositif pour VRS air-Q SP ou dans le groupe LMA Classic. La pression de fuite oropharyngée (critère d'évaluation principal), le taux de succès, les caractéristiques de l'insertion (temps d'insertion, facilité d'insertion, nécessité de manipulation du dispositif, insufflation gastrique, vue en bronchoscopie et complications oropharyngées à l'insertion et après le retrait [mal de gorge, dysphagie, dysphonie]) ont été comparés.*

Résultats *La pression de fuite oropharyngée moyenne (écart-type [ET]) juste avant l'insertion a été semblable pour l'air-Q SP et le LMA (respectivement 16,8 [4,9] contre 18,6 [5,5] cmH_2O; différence des moyennes, 1,8 cmH_2O; IC à 95 %, -0,5 à 4,2; P = 0,13] et n'était pas différente 10 minutes après l'insertion du dispositif. La pression inspiratoire maximum médiane (écart interquartile [IQR]) immédiatement après l'insertion était inférieure dans le groupe air-Q SP (11,0 [10,0-13,0] contre 13,0 [11,0-14,0] cmH_2O, différence médiane, 1,0 cmH_2O; IC à 95 %, 0,0 à 2,0; P = 0,03) mais aucune différence n'a été observée à dix minutes. Le temps d'insertion médian [IQR] a été plus court avec l'air-Q SP (15,9 [13,6-20,3] secondes contre 24 [21,2-27,1] s; différence des médianes, 8,1 s; IC à 95 %, 5,6 à 9,9; P < 0,001) et un meilleur niveau de vision bronchoscopique a été constaté avec l'air-Q SP immédiatement après l'insertion (P < 0,001). Aucune différence n'a été observée entre les groupes concernant les taux de succès des insertions à la première tentative, le taux global de succès des insertions, la facilité d'insertion et les complications.*

Conclusions *L'air-Q SP avait des pressions de fuite similaires, mais un temps d'insertion plus rapide et une meilleure visualisation bronchoscopique comparativement au LMA Classic. L'air-Q SP est une option acceptable pour remplacer le LMA Classic chez les patients adultes et peut s'avérer supérieur pour une intubation trachéale.*

Enregistrement de l'essai clinique *www.ClinicalTrials.gov (NCT02206438). Enregistré le 1*^{er} *août 2014.*

Supraglottic airway (SGA) devices are commonly used for elective patient ventilation and as a "rescue device" in various difficult airway algorithms.[1,2] The LMA® Classic™ SGA (LMA North America, Inc., San Diego, CA, USA) has been commercially available for almost three decades (Fig. 1a), and its safety and reliability have been established in both pediatric and adult patients.[3] Currently, many other SGAs are available and were developed based on the original LMA concept. Not surprisingly, as an established SGA with a proven clinical track record, the LMA has been and continues to be a standard for comparison.[4-10]

The recently developed self-pressurized air-Q® intubating laryngeal airway (air-Q SP) (Mercury Medical, Clearwater, FL, USA) is a single-use SGA that does not require cuff inflation. The original air-Q® intubating laryngeal airway (Cookgas LLC; Mercury Medical) was designed to facilitate tracheal intubation through its lumen. The air-Q SP differs from the original air-Q by the absence of an inflatable cuff and the continuity between the airway tube and cuff through an inner aperture at the junction (Fig. 1b). The communication orifice between the airway tube and periglottic cuff of the air-Q SP makes the intracuff pressure equilibrate dynamically with the airway pressure and is designed to adjust to the patient's pharyngeal and periglottic anatomy.[11]

Previous studies have shown the efficacy of the original air-Q as an airway maintenance device[12] and as a tracheal conduit for pediatric and adult patients.[13,14] Nevertheless, the only comparative study of the air-Q SP and other SGAs was performed in children,[6,15] and while its performance in adults has been described[16] there are no head-to-head comparative studies in adult patients.

The aim of this prospective randomized study was to evaluate the clinical performance of the air-Q SP compared with the LMA Classic in adult patients. The primary outcome variable was the oropharyngeal leak pressure and the secondary outcome variable was device insertion time. Other outcomes included device insertion characteristics, success rate, incidence of gastric insufflation, flexible bronchscopic laryngeal view, and complications

Methods

With approval from the Institutional Review Board of the Gangnam Severance Hospital, Yonsei University Health System (March 2014; REB file# 0081), adult patients (20-75 yr old) undergoing elective surgery (orthopedic, gynecologic, urologic) requiring general anesthesia were prospectively enrolled. Inclusion criteria included American Society of Anesthesiologists physical status I or II, anticipated surgical duration of less than two hours, and appropriateness for airway management with an SGA. Exclusion criteria included patients with abnormal anatomical structures who were considered at risk for

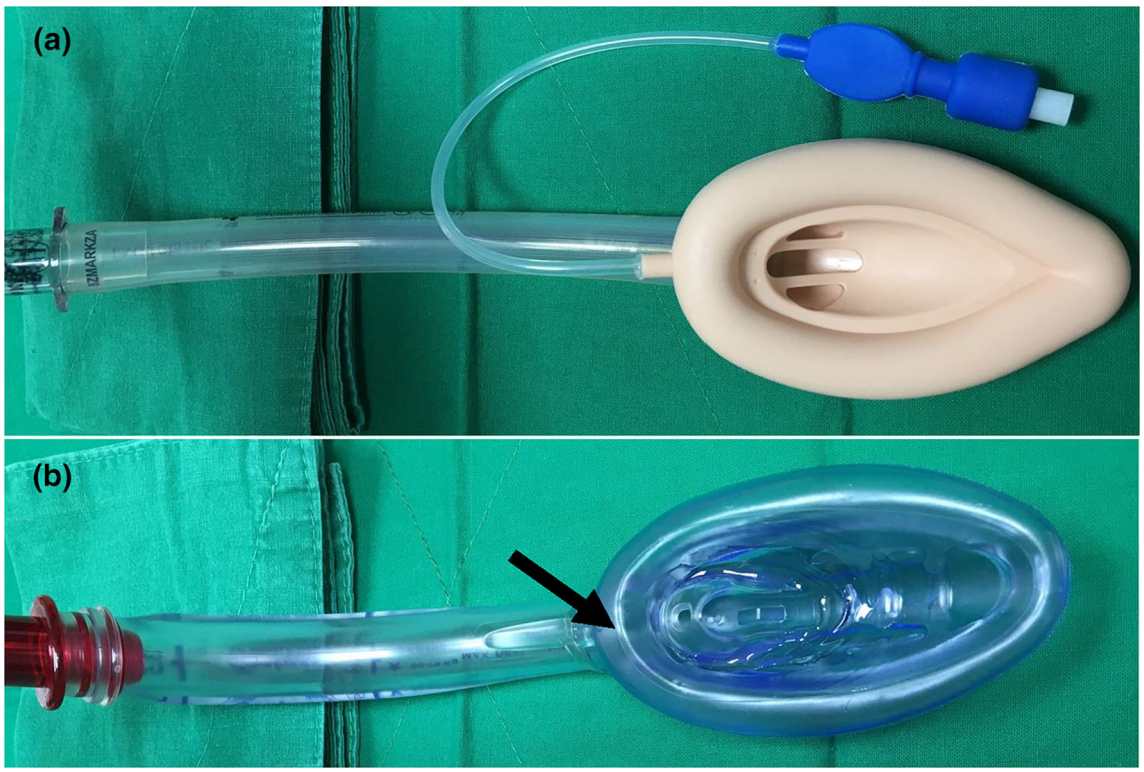

Fig. 1 a) size 4 LMA Classic supraglottic airway (SGA); b) size 3.5 self-pressurized air-Q (air-Q SP) SGA. Arrow indicates inner aperture that can be seen when the cuff is cut

difficult mask ventilation or intubation (e.g., morbid obesity, limited mouth opening, Mallampati score > 3, obstructive sleep apnea, micrognathia, decreased head/neck mobility), respiratory illness including upper respiratory infection or pneumonia within the six weeks preceding surgery, and risk of aspiration (e.g., reflux, pregnancy, or emergency surgery).

One of the study investigators (J.W.S.) enrolled the participants. Each study subject received anesthesia care from one of three consultant anesthesiologists (S.H.H., M.S.K., J.S.L.) experienced in the use of SGAs. No premedication was administered. Upon arrival in the operating room, patients were placed supine on the operating table with a pillow under the occiput to achieve a standardized neutral head position. Standard monitoring included a three-lead electrocardiogram, non-invasive blood pressure, and peripheral oxygen saturation (SpO_2). General anesthesia care was standardized regarding induction, using 2.0 $mg \cdot kg^{-1}$ propofol and remifentanil infusion (0.1-0.3 $\mu g \cdot min^{-1} \cdot kg^{-1}$), and rocuronium 0.6 $mg \cdot kg^{-1}$ was administered for muscle relaxation. General anesthesia was maintained with sevoflurane [age adjusted 0.6-0.9 minimum alveolar concentration (MAC) in a 50:50 mixture of oxygen and air] and remifentanil infusion (0.05-0.2 $\mu g \cdot min^{-1} \cdot kg^{-1}$). After loss of consciousness, patients were manually ventilated with a conventional facemask (fraction of inspired oxygen [F_IO_2] 1.0) until the appropriate depth of anesthesia and muscle relaxation were achieved (e.g., blood pressure stabilization, lack of motor response to jaw thrust)[17] after which insertion of the SGA was attempted.

Supraglottic airway device randomization was generated using a website (http://www.random.org/) and concealed in sealed, opaque envelopes, one of which was opened by an assistant (who was otherwise not involved in this study) just prior to anesthesia induction. Each SGA was lubricated with a water-soluble non-staining sterile lubricant gel (PROGEL®; Dayo Medical, Seoul, Korea) before placement. The size of the airway device was determined by the manufacturer's guidelines (air-Q SP: 30-50 kg - size 2.5, 50-70 kg - size 3.5, and 70-100 kg - size 4.5; LMA Classic: 30-50 kg - size 3, 50-70 kg - size 4, and 70-100 kg - size 5), and a standardized midline technique for device insertion was used according the manufacturer's guidelines (http://www.mercurymed.com/product-category/air-q-sp-self-pressurizing-airways-disposable/ for air-Q SP and http://www.lmaco-ifu.com for LMA Classic). With the LMA Classic, prior to its insertion, the cuff pressure was completely deflated. After insertion, intracuff pressure of the LMA Classic was set at 60 cmH_2O and maintained using a cuff pressure manometer (VBM Medizintechnik, Sulz, Germany).[18,19] The insertion of the airway devices was

conducted by one anesthesiologist with extensive experience but who was not otherwise involved in this study. The anesthesiologist who inserted the SGA could not be blinded while providing clinical care and assessing either device. All relevant information was transmitted directly to a non-blinded research assistant located in the operating room.

A maximum of two attempts at SGA insertion was allowed. Successful insertion was defined as the observation of symmetrical deep chest wall expansion during lung inflation (manual bagging) and a square-wave end-tidal CO_2 capnograph trace during expiration. If ventilation was assessed to be inadequate, the following manipulations were performed: gentle pushing or pulling on the SAD, head extension or flexion, and jaw thrust. In case of failure of insertion, the anesthesiologist was free to choose to insert another type of SGA or to intubate using conventional equipment (laryngoscope, endotracheal tube).

Oropharyngeal airway seal, the primary outcome of this study, was assessed by measuring the leak pressure. Airway leak pressure was determined by adjusting the pressure-limiting valve to 40 cmH_2O with a constant fresh gas flow of 3 $L{\cdot}min^{-1}$ and the ventilator (Primus^{TM} anesthetic work station; Drager, Lubeck, Germany) in "manual" mode. Oropharyngeal leak pressure was defined as the point that a steady state of airway pressure was reached,[20,21] as measured with the ventilator's pressure gauge and spirometer. During the leak pressure measurements, auscultation over the epigastrium with a stethoscope was done to detect the occurrence of gastric insufflation.

Patients were then mechanically ventilated with a tidal volume of 8 $mL{\cdot}kg^{-1}$ at F_IO_2 0.5, fresh gas flow of 2 $L{\cdot}min^{-1}$, and 0 cmH_2O positive end-expiratory pressure. The respiratory rate (8-12 $breaths{\cdot}min^{-1}$) was adjusted to maintain an end-tidal CO_2 volume of 35-40 mmHg. Leak volume was measured by the difference between the inspiratory and expiratory tidal volumes and obtained from the anesthesia machine's spirometry measurements during mechanical ventilation. The leak volume was measured five times, and the average was recorded. Peak inspiratory pressures were also noted.

Insertion time, a secondary outcome of this study, was the time interval between picking up the airway device and observation of the upstroke of the first the end-tidal CO_2 square-wave capnography trace during manual "bag" ventilation. The number of insertion attempts was also counted. The ease of insertion was evaluated using a subjective grading scale of 1-4[22]: (1 = no resistance; 2 = mild resistance; 3 = moderate resistance; 4 = inability to insert the device).

A flexible bronchoscope (Olympus Optical Co., Tokyo, Japan) was used to assess the anatomical position of the device in relation to the glottis just proximal to the airway orifice. The image was graded as follows[23]: grade 1, larynx only seen; grade 2, larynx and epiglottis posterior surface seen; grade 3, larynx and epiglottis tip or anterior surface seen, less than 50% visual obstruction of epiglottis to larynx; grade 4, epiglottis down-folded and its anterior surface seen, greater than 50% visual obstruction of the epiglottis to larynx; grade 5, epiglottis down-folded and larynx not seen directly.[12,23] Airway leak pressure, leak volume, and bronchoscopic view were also measured ten minutes after the initial assessment.[6,23]

Complications during device insertion and maintenance of anesthesia such as desaturation ($SpO_2 < 90\%$), airway obstruction, cough, airway manipulation, and blood staining on the device after its removal were recorded. All patients were interviewed the following day (hospital ward visit or telephone call) by a nurse who was not otherwise part of the study to inquire about postoperative complications such as sore throat, dysphonia, and dysphagia.

A previous study showed that the mean (SD) airway sealing pressures of the LMA Classic were 23.0 (4.4) cm H_2O compared with the modified LMA[4] and 26.1 (2.1) cmH_2O compared with the LMA Supreme^{TM}.[9] Using these values, to detect a difference of 13% with 90% power at a two-sided significance level of 5%, we determined that 38 patients in each group would be required. Forty-two patients in each group were recruited to compensate for a 10% dropout rate.

We analyzed the data using SPSS (version 21; SPSS Inc., Chicago, IL, USA) and R-statistical software (version 3.3.3; R Foundation for Statistical Computing, https: // www. rproject.org). Continuous variables were analyzed by a two-sample t test, assuming data were normally distributed. The normality assumption was verified by the Shapiro-Wilk normality test for residuals obtained from the linear regression equation estimated from each continuous variable. When a P value derived from the Shapiro-Wilk normality test was < 0.05, the Wilcoxon rank-sum test was applied as a non-parametric alternative to the t test. When using a two-sample t test, Welch's t test was applied if variances between the two groups were assumed to be unequal. Categorical variables are reported as numbers and percentages and analyzed using the Chi-square or Fisher exact test. Ordinal variables are reported as numbers and analyzed using the Mann-Whitney U test. $P < 0.05$ was considered statistically significant.

Results

Eighty-four study patients were enrolled (8 July 2014 to 17 October 2014). All provided consent and none were excluded for protocol violation. Three patients were subsequently withdrawn because of failure of device

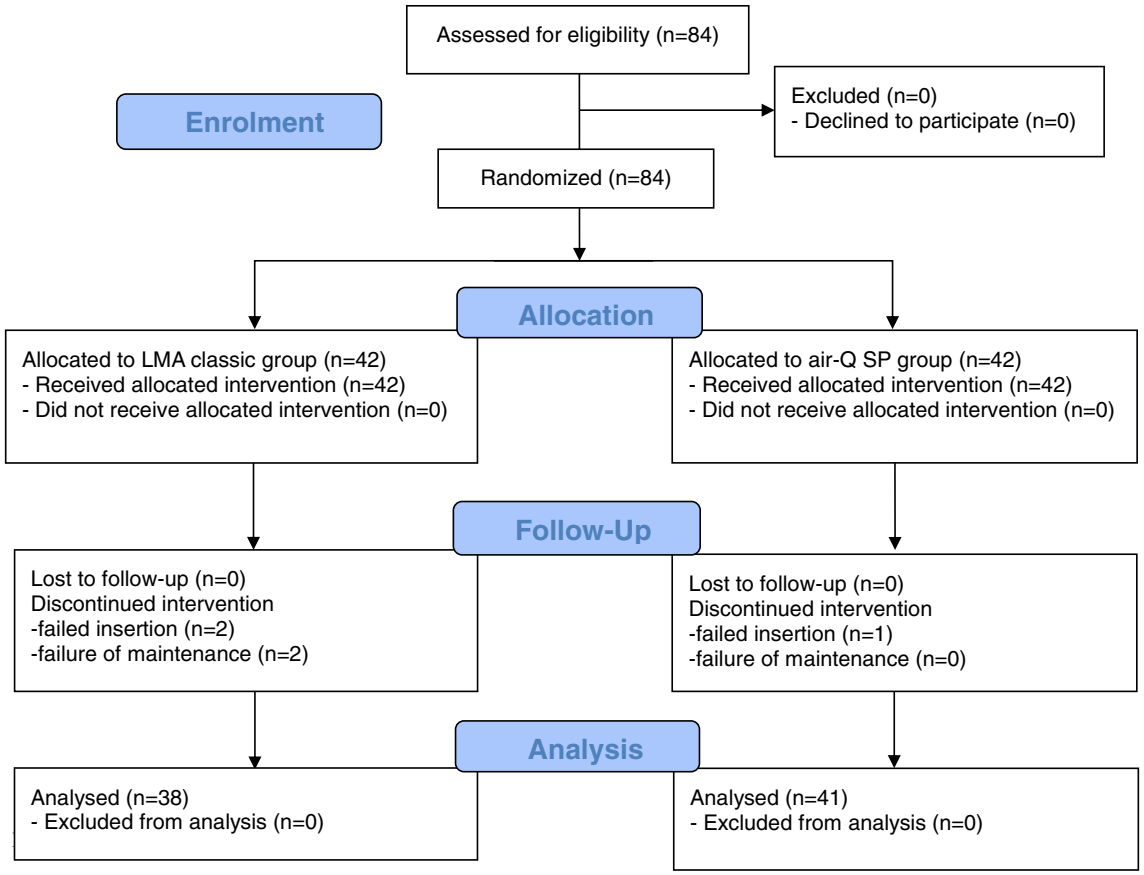

Fig. 2 Flow diagram of the study design

insertion, one from the air-Q SP group and two from the LMA Classic group. Tracheal intubation was performed for these three patients. Two other patients with successful LMA Classic insertion were subsequently converted to I-gel® SGA use (Intersurgical Ltd., Wokingham, UK) because of failure of the LMA Classic during surgery. Thus, complete data were available for 41 patients in the air-Q SP and 38 patients in the LMA Classic groups (Fig. 2).

Patients who were managed with either SGA could not be differentiated by their demographic characteristics, and both groups underwent similar types and durations of procedures (Table 1). The overall rates of successful device insertion, successful device insertion at first attempt, and number of patients requiring device manipulations were similar in both groups. Insertion time of the air-Q SP was faster compared with the LMA Classic (15.9 [13.6-20.3] sec *vs* 24 [21.2-27.1] sec; mean difference, 8.1 sec; 95% CI, 5.6 to 9.9; $P < 0.001$, Table 2).

Sealing function and ventilation-related data are summarized in Table 3. There were no differences in oropharyngeal leak pressures initially, just after successful device insertion [air-Q SP 16.8 (4.9) *vs* LMA 18.6 (5.5) cmH_2O, mean difference, 1.8 cmH_2O; 95% CI, -0.5 to 4.2; $P = 0.125$], and at ten minutes following device insertion [mean difference, 1.6 cmH_2O; 95% CI, -0.7 to 3.9; $P = 0.18$]. Although the air-Q SP group showed lower median [IQR] peak inspiratory pressures initially just after device insertion (11.0 [10.0-13.0] cmH_2O *vs* 13.0 [11.0-14.0] cmH_2O; median difference, 1.0 cmH_2O; 95% CI, 0.0 to 2.0; $P = 0.03$), no difference was observed at ten minutes. Both groups showed similar rates of gastric insufflation.

Bronchoscopic grades of view are summarized in Table 2. The air-Q SP provided improved bronchoscopic grades of view initially and at ten minutes following device insertion compared with the LMA Classic.

Blood staining on the device was seen in four patients in the air-Q SP group and five patients in the LMA Classic group. Postoperative pharyngolaryngeal complications for the two types of devices were similar (Table 4). There were no cases of aspiration, hypoxia, or $SpO_2 < 90\%$ with either device.

Discussion

In our study, oropharyngeal leak pressure, the primary endpoint of the investigation, was similar with both

Table 1 Characteristics of patients assigned to the LMA Classic and the self-pressurized air-Q (air-Q SP) supraglottic airways

	LMA Classic $n = 38$	air-Q SP $n = 41$
Age, yr	44.5 [34.8-55.0]	44.0 [32.0-51.0]
Gender, M/F, *n* (%)	9 (23.7)/29 (76.3)	11 (26.8)/30 (73.2)
Weight, kg	56.1 [52.0-62.8]	57.0 [52.6-65.0]
Height, cm	161.7 (8.1)	163.5 (7.6)
Device size, *n* (%)	3: 8 (21.1)	2.5: 5 (12.2)
	4: 27 (71.1)	3.5: 30 (73.2)
	5: 3 (7.8)	4.5: 6 (14.6)
Operation time, min	30.0 [15.0-56.3]	35.0 [15.0-55.0]
Anaesthesia time, min	62.5 [48.8-92.5]	60.0 [47.5-87.5]
Type of surgery *n* (%)		
Orthopedic	18 (47.4)	18 (43.9)
Gynecologic	17 (44.7)	21 (51.2)
Urologic	3 (7.9)	2 (4.9)

Data are expressed as mean [standard deviation (SD)], median [interquartile range], or number (%)

devices. Nevertheless, the air-Q SP had a faster insertion time and improved fibreoptic view compared with the LMA Classic.

Oropharyngeal leak pressure is a parameter of sealing function. To achieve a good seal, proper cuff inflation and cuff pressure monitoring are essential when using SADs with inflatable cuffs. The wider mask bowl of the air-Q SP and its curved airway tube may improve an approximation to the oropharynx, providing greater lateral stability and better sealing.[11] The raised mask heel and space above the keyhole-shaped ventilating orifice of the air-Q SP are designed to achieve better airway sealing pressure and epiglottis isolation.[12] Importantly, the non-inflatable cuff of the air-Q SP does not cause deterioration of the sealing function due to improper inflation. As such, we were surprised that the oropharyngeal leak pressures of the air-Q SP were similar to those of the LMA Classic, contrary to previously reported results.[11,15] We postulate that in our study the maintained intracuff pressure of the LMA Classic (60 cmH_2O) may have contributed to this result. Such well-controlled intracuff pressures may not have been achieved in previous studies, and it is well known that over-inflation can interfere with the LMA Classic seal. We speculate that without continuous LMA cuff pressure monitoring, the air-Q SP may provide a better seal. The peak inspiratory pressure at the initial assessment was lower in the air-Q SP but the clinical significance of this difference is questionable. The wider diameter and bigger cuff of the air-Q may contribute to this difference.

The air-Q SP had a faster insertion time compared with the LMA Classic, as found in a previous study.[6] We speculate that this is related to the non-requirement for cuff inflation consistent with the non-inflating I-gel's faster insertion time compared with the LMA Classic.[10] Using a partially inflated cuff, which omits the cuff-inflation step, the insertion times of the LMA Classic and the LMA Unique have been shown to be comparable with the I-gel.[5,24] Faster insertion time may be of clinical importance particularly when SGA insertion is preceded by an interval of hypoxia.

Table 2 The insertion characteristics and flexible bronchoscopic view through the LMA Classic and the self-pressurized air-Q (air-Q SP) supraglottic airways

	LMA Classic $n = 38$	air-Q SP $n = 41$	*P*
Successful insertion overall, *n* (%)	38 (95)	41 (98)	> 0.99
Successful insertion at first attempt, *n* (%)	31 (81.6)	34 (82.9)	0.87
Ease of device insertion* *n* (%)			0.36
1	34 (89.5)	31 (75.6)	
2	3 (7.9)	5 (12.2)	
3	1 (2.6)	4 (9.8)	
4	0 (0.0)	1 (2.4)	
Insertion time, sec [IQR]	24.0 [21.2-27.1]	15.9 [13.6-20.3]	< 0.001
Device manipulation, *n* (%)	4 (10.5)	5 (12.2)	>0.99
Bronchoscopic view through device** 1/2/3/4/5 *n*			
Initial assessment	14/10/7/3/4	33/4/3/0/1	< 0.001
10 min after initial assessment	13/11/5/5/4	32/6/2/0/1	< 0.001

*Ease of insertion graded as 1 = no resistance, 2 = mild resistance, 3 = moderate resistance, or 4 = inability to place the device. **bronchoscopic view graded as 1: larynx only seen; 2: larynx and epiglottis posterior surface seen; 3: larynx and epiglottis tip or anterior surface seen, less than 50% visual obstruction of epiglottis to larynx; 4: epiglottis down-folded and anterior surface seen, greater than 50% visual obstruction of epiglottis to larynx; 5: epiglottis down-folded and larynx not seen directly. Data are expressed as number (%) or median [interquartile range]

Table 3 Sealing function and ventilation with the laryngeal mask airway (LMA Classic) and self-pressurized air-Q (air-Q SP) supraglottic airways

	LMA Classic $n = 38$	air-Q SP $n = 41$	Mean/median difference (95% CI)	P
Oropharyngeal leak pressure, cmH_2O				
Initial assessment	18.6 (5.5)	16.8 (4.9)	1.8 (−0.5 to 4.2)	0.13
10 min after initial assessment	19.7 (5.3)	18.1(4.9)	1.6 (−0.7 to 3.9)	0.18
Number of gastric insufflations, n (%)				
Initial assessment	0 (0)	1 (2)		>0.99
10 min after initial assessment	0 (0)	1 (2)		>0.99
Peak inspiratory pressure, cmH_2O				
Initial assessment	13.0 [11.0-14.0]	11.0 [10.0-13.0]	1.0 (0.0 to 2.0)	0.03
10 min after initial assessment	13.0 [11.0-15.0]	12 [10.0-14.0]	1.0 (0.0 to 2.0)	0.05

Data are expressed as mean (standard deviation) or median [IQR; interquartile range]; CI = confidence interval

$P < 0.05$ designates a statistically significant difference between groups

Table 4 Postoperative complications in patients assigned to the laryngeal mask airway (LMA Classic) and the self-pressurized air-Q (air-Q SP) supraglottic airways

	LMA Classic $n = 38$	air-Q SP $n = 41$	P
Recovery room, n (%)			
Sore throat	11 (29)	19 (46)	0.11
Dysphagia	18 (47)	20 (49)	0.90
Dysphonia	21 (55)	18 (44)	0.31
After 24 hr, n (%)			
Sore throat	6 (16)	9 (22)	0.49
Dysphagia	16 (42)	19 (46)	0.71
Dysphonia	10 (26)	5 (12)	0.11

Our observation of similar ease of device insertion is at odds with reports that the air-Q SP is more difficult to place despite a shorter insertion time.[12] The first-attempt insertion success rates were similar with both devices, as has been shown previously in adults and children.[12,15,16]

The flexible bronchoscopic fields of view through the air-Q SP were superior to those through the LMA Classic as reported previously.[12,15] Nevertheless, the relationship between the field of view and function of the device, including the airway seal, remains obscure. For example, it has been suggested that with the air-Q SP a superior bronchoscopic view does not correspond to a superior functional positioning of the device, and a poor view does not imply an obstructed airway or inadequate seal.[25] In point of fact, a poor view that included downwards folding of the epiglottis did not correlate with inadequate ventilation in our study. Nevertheless, we surmise that the superior bronchoscopic view with the air-Q SP suggests that it can serve as a reliable conduit for tracheal intubation and so would be useful in a "difficult intubation" situation.[16,26] Moreover, the air-Q SP's design has been shown to help position the endotracheal tube at a correct depth in the trachea.[27]

When the LMA Classic is overinflated, it can result in laryngeal mucosal damage and ischemia, resulting in sore throat, neuropraxia, regurgitation, and arytenoid dislocation.[28-31] With the air-Q SP, regulation of intracuff pressure by airway pressure, resulting in a maintained lowered intracuff pressure and an optimized airway seal, is a previously identified clinical advantage.[11] We were surprised, therefore, that the SGAs could not be differentiated on the basis of postoperative complications.

Several limitations of this study are acknowledged. It included relatively healthy patients with an anticipated "easy airway". Care must be taken when extrapolating these observations to patients with characteristics that can interfere with airway management (e.g., morbid obesity, abnormal airway anatomy, chronic obstructive pulmonary disease, etc.). We cannot preclude bias introduced by using a non-blinded clinician and research assistant. The study does not account for the potentially confounding variable of "learning curves" associated with insertion of the SGAs. Finally, the study is almost certainly underpowered to reveal differences in rare postoperative complication rates.

In conclusion, the faster insertion time of the air-Q SP and superior bronchoscopic view through the bronchoscope suggest that it offers advantages compared with the LMA Classic. We speculate that the air-Q SP may be a superior conduit for tracheal intubation.

Conflicts of interest and source of funding The authors have no funding or conflicts of interest to disclose.

Editorial responsibility This submission was handled by Dr. Steven Backman, Associate Editor, *Canadian Journal of Anesthesia.*

Author contributions *Sang Hee Ha* and *Jong Seok Lee* contributed substantially to all aspects of this manuscript, including conception and design, acquisition, analysis, and interpretation of data and drafting the article. *Min-Soo Kim* contributed substantially to the conception and design, acquisition, and analysis. *Jiwoo Suh* contributed substantially to the acquisition of data.

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