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Guided vs. non-guided insertion of Ambu AuraGain™ in edentulous patients

Introduction

Since the introduction of the laryngeal mask airway (LMA) in 1981 supraglottic airway devices (SGA) have become a standard airway device for elective anesthesia in both adults and children. Since then, many studies have demonstrated the usefulness for controlled and spontaneous ventilation [14, 16, 20, 25].

The prevalence of edentulism in the geriatric population (>65 years) varies from 13% to 60% depending on the country [7, 9]. In most anesthesia institutions, safety concerns cause mobile dentures to be removed before inducing anesthesia, even though some data have shown better ventilation with the face mask when dentures are left in place during induction [2, 7].

In the absence of teeth the benefit of an integrated bite guard, as it is known from second-generation SGA, is lost and the SGA tends to rotate. Beydes et al. described faster insertion times in edentulous patients [1]. This seems to be due to the missing teeth, which allows more room for introduction of the SGA. On the other hand, the oropharyngeal leak pressure (OLP) in the same publication was significantly lower than previously published for patients with teeth [1, 18, 22, 26]. A reasonable explanation might be that because of changes in the anatomic shape of the oropharyngeal cavity SGA have higher probability of malposition and displacement.

The Ambu® AuraGain™ (Ambu®, Ballerup, Denmark) disposable laryngeal mask is an anatomically curved, second generation SGA with integrated gastric access and intubation capability. Previous studies have shown OLP and insertion rates to be comparable to those of other second generation SGAs [18, 22, 26].

Brimacombe et al. in 2004 described a guided insertion technique for the LMA Proseal™ (Teleflex Medical GmbH, Athlone, Co Westmeath, Ireland). A gum-elastic bougie is introduced into the esophagus and leads the SGA into the correct position [6]. Recently, Kim et al. showed better OLP when using a laryngoscope-guided insertion technique than with blind insertion [15].

The aim of this randomized trial was to test the hypothesis that a guided insertion technique with a continuous splinting of the SGA achieves better OLP in edentulous patients and causes fewer displacements despite difference of anatomic shapes in edentulous patients, leading to a more reliable performance.

Material and methods

This randomized, non-blinded trial was performed between May 2019 and November 2019 at the Department of Anaesthesiology and Intensive Care Medicine of Innsbruck Medical University Hospital, Austria.

Ethics approval was obtained (EK Nr: 1283/2018, on 27.02.2019) from the local Ethics Committee (Ethikkommission der Medizinischen Universität Innsbruck—Austria). The study was registered with Clinical Trials PRS (ClinicalTrials.gov ID: NCT03933644) and the study was performed according to the Helsinki Declaration.

A total of 72 patients listed for elective surgery were included in this trial. Patients were asked for written informed consent before inclusion. Inclusion criteria were defined as age between 50 and 90 years, the presence of a mobile teeth prosthesis and an American Society of Anesthesiology (ASA) score I–III. Patients were excluded when one or more of the following criteria were given:

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Table 1 Demographic comparison data for the Ambu AuraGain™ with guided insertion versus without guided insertion. Data are given in mean

	Ambu®AuraGain™ with guided insertion	Ambu®AuraGain™ without guided insertion	*p*
N	36	36	
Sex n (%)			
Male	26 (72)	24 (67)	Ns
Female	10 (28)	12 (33)	Ns
Age (years) [sd] {range}	73.6 [±10.5]{56–90}	73 [±9.1]{51–87}	Ns
Weight (kg) [sd]	75.7 [±17.2]	72 [±12.0]	Ns
Height (cm) [sd]	171 [±11.2]	169 [±9.0]	Ns
BMI	25 [±3.8] {18–33}	25[±3]{16–30}	Ns
ASA status *n* (%)			Ns
I	0 (0)	0 (0)	
II	8 (22)	12 (33)	
III	22 (78)	24 (67)	

BMI body mass index, *ASA* American Society of Anesthesiology

Table 2 Anesthetic induction doses, anesthesia depth, cardiorespiratory data, anesthesia duration and surgery duration. Data are presented in mean (SD) [range] or numbers {%}

	Ambu®AuraGain™ with guided insertion	Ambu®AuraGain™ without guided insertion	*p*
N	36	36	
Fentanyl; µg.kg^{-1}	2.5 (±0.6)	3.0 (±0.9)	Ns
Propofol; mg.kg^{-1}	1.7 (±0.6)	1.7 (±0.6)	Ns
Rocuronium; mg.kg^{-1}	0.3 (±0.6)	0.3 (±0.1)	Ns
Systolic blood pressure; mm Hg	135 (±26)	131 (±27)	Ns
Heart rate; min^{-1}	64 (±13)	70 (±10)	Ns
Pulse oximetry; %	96 (±1.8)	96 (±2.3)	Ns
Narcotrend (A/B/C/D/E) {%}			
0 min	0/0/3/43/54	0/0/3/40/57	Ns
15 min	0/0/0/38/62	0/0/0/50/50	Ns
30 min	0/0/0/60/40	0/0/0/50/50	Ns
Anesthesia duration	149 (89) [37–393]	138 (±77) [33–333]	Ns
Surgery duration	104 (±81) [7–340]	95 (±69) [7–265]	Ns
Type of surgery (Vasc/Visc)[a]	17/19	17/19	
Position (S/T)[b]	31/5	33/3	Ns

[a] Vasc stands for vascular surgery, Visc stands for visceral surgery

[b] *S* stands for supine position, *T* stands for Trendelenburg position

1) a known or suspected difficult airway, 2) anatomical disorders or pathologies in the upper airway, 3) a body mass index (BMI) > 40 kg/m^2, 4) chronic pulmonary disease.

All patients were anesthetized by one of five consultant anesthetists (>1000 SGA insertions).

Randomization (Ambu AuraGain™ with guided insertion or Ambu AuraGain™ without guided insertion) was generated with the algorithm provided by *randomization.com* and was revealed to the study investigator just prior to anesthesia induction by opening a closed envelope.

Thereafter, patients fasted for 6 h for solids and 2 h for liquids.

Patients were positioned supine with their head on a soft pillow (7 cm height) and routine monitoring, i.e. electrocardiography (ECG), pulse oximetry and blood pressure measurement, was installed. After insertion of a peripheral vein cannula, patients were preoxygenated with 6l O_2 over 3 min. Anesthesia was induced with fentanyl 2–3 µg kg^{-}1, propofol 2–4 mg kg^{-1} and rocuronium 0.3–0.4 mg kg^{-1}. Rocuronium was used to achieve a standardized setting as some patients underwent surgical procedures where use of muscle relaxants was mandatory (laparoscopic interventions).

Anesthesia was maintained with remifentanil (0.1–0.3 µg kg^{-1} min^{-1}) and propofol (75–125 g kg^{-1} min^{-1}) or sevoflurane 2–3% in 33% O_2. Using a Narcotrend™ system (MT Monitortechnik, Bad Bramstedt, Germany), anesthesia depth was measured while aiming for a Narcotrend score of C–D before insertion and during maintenance.

Supraglottic airway insertion without guided insertion

For the Ambu AuraGain™ without gastric tube group SGA insertion was performed with a classical midline insertion technique according to the manufacturer's recommendation.

The patient's head was slightly extended and the index finger was allowed to be used for insertion.

Insertion time was defined as the time interval between removal of the face mask and assurance of effective ventilation through the SGA by capnometric detection of end-tidal CO_2 and bilateral chest movement. SGA devices were cuffed at 60 cm H_2O using a cuff pressure gauge.

One of the following criteria defined failed insertion: impossible passage of the SGA through the pharynx or unsatisfactory ventilation (tidal volume < 4 ml/kg). In this case a second attempt was allowed using a slightly lateral insertion approach.

The Ambu AuraGain™ was then fixed according to the manufacturer's recommendations.

Supraglottic airway insertion with guided insertion

For insertion of the Ambu AuraGain™ with gastric tube the guided technique described by Brimacombe et al. was used [6]. This includes the following steps: 1) the distal end of a precooled well-lubricated 125-cm long gastric tube (Duodenal Tube Levin 12 Fr; Unomedi-

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Guided vs. non-guided insertion of Ambu AuraGain™ in edentulous patients

Abstract

Background. Supraglottic airway devices perform more poorly and have lower oropharyngeal leak pressure in edentulous patients than in patients with teeth. The Ambu Aura Gain is a newer second generation supraglottic airway device.

Objective. This randomized clinical trial assessed the oropharyngeal leak pressure in edentulous patients using the Ambu Aura Gain with a gastric tube for insertion guidance and without insertion guidance.

Material and methods. Patients with ASA (American Society of Anesthesiology) physical status I–III were recruited. Primary outcome was oropharyngeal leak pressure after insertion. Secondary outcome parameters were oropharyngeal leak pressure 15 min and 30 min after insertion, insertion time, insertion attempts and glottis view through flexible fiberscope.

Results. In this study 72 patients aged between 51 and 90 years (mean 73 years) were randomly allocated to the "with guidance" ($n = 36$) or the "without guidance" group ($n = 36$). Mean (SD) oropharyngeal leak pressure in "with guidance" and "without guidance" group was 24 cm H_2O and 24 cm H_2O (ns), respectively. A difference was found in mean insertion time with guidance versus without guidance group 52 s (45 s) vs. 26 s (15 s) ($p < 0.001$). No difference was found in any of the other secondary outcome parameters.

Conclusion. A guided insertion technique does not improve oropharyngeal leak pressure of the Ambu AuraGain™ in edentulous patients. As the only difference is an increase in insertion time this technique is of no benefit for this population.

Keywords

Laryngeal mask airway · Difficult airway · Difficult airway management · Dental prosthesis · Edentulous

Geführte vs. nichtgeführte Insertion von Ambu AuraGain™ bei zahnlosen Patienten

Zusammenfassung

Hintergrund. Supraglottische Atemwegshilfen zeigen bei zahnlosen Patienten im Vergleich zu Patienten mit Zähnen deutliche Schwächen in der Performance und erreichen niedrigere oropharyngeale Verschlussdrücke.

Ziel der Arbeit. Die Ambu AuraGain™ ist eine relativ neue supraglottische Atemwegshilfe der zweiten Generation. Ziel der vorliegenden randomisierten Studie ist es, den oropharyngealen Verschlussdruck der Ambu AuraGain™ in Abhängigkeit von der Insertionstechnik (mit Magensonde als Führungsschiene oder konventionell ohne Führungsschiene) zu untersuchen.

Material und Methoden. Es wurden Patienten mit einem ASA(American Society of Anesthesiology)-Status I–III eingeschlossen. Als primäre Outcome-Parameter wurde der oropharyngeale Verschlussdruck unmittelbar nach Insertion gewählt. Sekundäre Outcome-Parameter waren oropharyngealer Verschlussdruck 15 min und 30 min nach Insertion, die Insertionszeit, Anzahl der Insertionsversuche und die fiberoptische Lageevaluation der Glottis.

Ergebnisse. Insgesamt 72 Patienten zwischen 51 und 90 Jahren (Mittelwert: 73) wurden nach Randomisierung der Gruppe mit Führung ($n = 36$) oder ohne Führung ($n = 36$) zugewiesen. Der mittlere (SD) oropharyngeale Verschlussdruck betrug sowohl in der Gruppe mit als auch in der Gruppe ohne Führung 24 cm H_2O (ns). Ein deutlicher Unterschied ergab sich in der Insertionszeit (Gruppe mit vs ohne Führung 66 s [45] vs. 32 s [15]; $p < 0.001$). Auch in alle weiteren sekundären Endpunkten zeigten sich keine signifikanten Unterschiede zwischen den zwei Einführungstechniken.

Diskussion. Unsere Studie zeigt, dass eine geführte Insertion bei zahnlosen Patienten den oropharyngealen Verschlussdruck der Ambu AuraGain™ Larynxmaske nicht verbessert. Jedoch im Vergleich zu anderen untersuchten supraglottischen Atemwegshilfen ist der oropharyngeale Verschlussdruck der Ambu AuraGain™ bei diesem Patientenkollektiv deutlich höher.

Schlüsselwörter

Larynxmaske · Schwieriger Atemweg · Schwieriges Atemwegsmanagement · Zahnprothesen · Zahnlos

cal A / S, Birkerød, Denmark) was advanced 10–15 cm into the esophagus under gentle finger guidance, while an assistant held the proximal end of the gastric tube and the SGA; 2) the Ambu AuraGain™ SGA was inserted using a digital insertion technique, while the assistant stabilized the proximal end of the gastric tube to avoid further penetration into the esophagus; 3) after correct placement, the gastric tube was advanced into the stomach, with the SGA held in the correct position. Then the device was cuffed at 60 cm H_2O and correct fixation of the SGA was performed according to the manufacturer's recommendations. Correct position of the gastric tube was assessed by suctioning off gastric fluid or detecting injected air with an epigastric stethoscope [5].

Insertion time was calculated from removal of the face mask until effective ventilation as previously defined.

Failed attempts were defined by one of the following criteria: impossible passage of the SGA through the pharynx, impossible passage of the gastric tube through the pharynx or esophagus or unsatisfactory ventilation (tidal volume < 4 ml/kg). If a first attempt failed, a second insertion attempt using a slightly lateral approach was allowed.

The etiology of failed insertion was documented. Patients were then ventilated with a tidal volume of 6–8 ml/kg, respiratory rate 12/min and inspiratory: expiratory rate 1:2.

After that, the oropharyngeal leak pressure (OLP) was assessed by closing the expiratory valve at 40 cm H_2O at a fixed gas flow of 4 l/min using a digital manometer (Mallinckrodt Medical,

Table 3 Device placement for Ambu®AuraGain™ with guided insertion and without guided insertion: Insertion success, insertion time, etiology of failed insertion, oropharyngeal leak pressure, visible blood among initial devices and fiber optic position of the airway tube. Data are mean (SD) [range] or numbers {%}

	Ambu®AuraGain™ with guided insertion	Ambu®AuraGain™ without guided insertion	*p*
N	36	36	
PRIMARY VARIABLE			
Oropharyngeal leak pressure (OLP); cmH_2O	24 (±7) [12–40]	24 (±6) [10–40]	Ns
SECONDARY VARIABLES			
OLP after 15 min; cmH_2O OLP after 30 min; cmH_2O	25 (±7) [15–40] 25 (±7) [14–40]	24 (±6) [14–40] 24 (±6) [15–40]	Ns ns
Gastric leak pressure; cmH_2O	25 (±6) [12–40]	23 (±6) [10–38]	Ns
Fiber optic position airway tube 4/3/2/1[b]; *n*	22/10/3/0	17/13/3/0	Ns
Insertion success; n {%}			
First attempt	32 {89}	31 {86}	Ns
Second attempt	4 {11}	5{13}	Ns
Insertion failed	2 {6}	3 {8}	Ns
Overall	34 {94}	33{92}	Ns
Insertion time; s[c]	52 (±45) [19–250]	26 (±15) [15–75]	<0.001
Etiology of failure; n {%}			
$SpO_2 < 90\%$	0	0	
Failed ventilation after 2 insertion attempts[a]	2 {6}	3 {8}	Ns
Visible blood staining; *n* {%}	1 {3}	1 {3}	Ns
Manipulations; *n* {%}	8 {28}	3 {8}	Ns

[a] maximum expired tidal volume < 4 ml kg^{-1} or end-tidal CO_2 > 50 mm Hg when correctly positioned
[b] 4: only vocal cords visible; 3: vocal cords plus posterior epiglottis; 2: vocal cords plus anterior epiglottis; 1: vocal cords not seen
[c] Insertion time values are given as median

Athlone, Ireland) and noting the airway pressure at which equilibrium was achieved [13]. Gastric leak pressure was obtained by positioning a stethoscope over the epigastrium and noting the airway pressure at which a gastric air leak was detectable.

Next, a flexible bronchoscope with a diameter of 2.8 mm (Olympus BF-XP 160 [Olympus Europe GmbH, Hamburg, Germany]) was introduced into the SGA until 1 cm before the distal orifice, and the fiber optic score was noted using a previously described score (1: no vocal cords visible; 2: vocal cords and anterior epiglottis visible; 3: vocal cords and posterior epiglottis visible; 4: vocal cords visible) [3].

Thereafter, surgical procedures were allowed to start.

15 and 30 min after SGA insertion OLP was measured again.

Type of surgery and patient position were also noted.

Statistical analysis and data collection

Primary outcome in this trial was OLP after insertion.

Secondary outcome parameters were OLP 15 and 30 min after SGA insertion, gastric leak pressure, insertion time, insertion attempts, fiber optic score and blood staining after removal.

Based on the data for second generation SGA in edentulous patients from a previous study we expected an average value of 20 cm H2O for the control group (Ambu®AuraGain™ without guided insertion) [1].

Aiming for $p < 0.05$ and a power of 0.9, a sample size of 72 participants was calculated to detect a clinically important difference of 30% (6 cm H2O).

Data distribution was determined with the Kolmogorov-Smirnov test. Intergroup comparisons were performed with the Mann-Whitney U-test. The χ^2-test was used to compare categorical data. Additionally, differences within the groups (e.g. OLP at different time points) were assessed with the Wilcoxon test (2 groups) or the Friedman test (>2 groups). SPSS (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA) was used for all statistical analyses. *P* values < 0.05 were considered statistically significant.

Results

A total of 72 edentulous patients were randomly assigned to the Ambu®AuraGain™ with guided insertion group or the Ambu®AuraGain™ without guided insertion group (36 patients per group) after written informed consent was granted. Demographic data did not differ between the groups and are shown in **Table 1**. No difference between the two groups was found for doses of anesthesiologic agents; neither cardiorespiratory data nor anesthesia depth differed between the two groups (see **Table 2**).

Data for insertion success and oropharyngeal as well as gastric leak pressure are demonstrated in **Table 3**. The only difference between the two groups was insertion time, which was significantly longer for the with guided insertion group than for the without guided insertion group (52 vs. 26 s; *p*:<0.001). Mean oropharyngeal leak pressure (OLP) was the same for the with guided insertion group and the without guided insertion group (24 vs. 24 cm H_2O). Also, the OLP did not differ significantly after 15 and 30 min (25 vs. 24 cmH_2O after 15 min and 24 vs 24 cm H_2O after 30 min). Also, no significant difference was found when OLP after 0 min, after 15 min and after 30 min within the groups were compared (with guided insertion vs. without guided insertion, Friedman test; *p*: 0.571 vs. *p*: 0.744, respectively).

A second attempt was needed in four patients with guided insertion and in five

Table 4 Device placement for patients ≤ 76 years and patients > 76 years: Insertion success, insertion time, etiology of failed insertion, oropharyngeal leak pressure, visible blood among initial devices and fiber optic position of the airway tube. Data are mean (SD) [range] or numbers {%}

	Patients ≤ 76 years	Patients > 76 years	*p*
N	39	33	
PRIMARY VARIABLE			
Oropharyngeal leak pressure (OLP); cmH_2O	24 (±7) [10–40]	24 (±6) [10–40]	Ns
SECONDARY VARIABLES			
OLP after 15 min; cmH_2O	24 (±7) [14–40]	25 (±6) [10–40]	Ns
OLP after 30 min; cmH_2O	24 (±7) [14–40]	24 (±6) [15–40]	ns
Gastric leak pressure; cmH_2O	24 (±7) [10–40]	24 (±6) [10–40]	Ns
Insertion success; n {%}			
First attempt	36 {92}	26 {82}	Ns
Second attempt	2 {8}	3 {18}	Ns
Insertion failed	1{2}	4 {12}	Ns
Overall	38 {97}	29 {87}	Ns
Etiology of failure; n {%}			
$SpO_2 < 90\%$	0	0	
Failed ventilation after 2 insertion attempts	1{3}	4 {12}	Ns

without guided insertion. In two patients in the with guided insertion group and in three patients in the without guided insertion group insertion failed. In all five patients no sufficient ventilation could be achieved after two insertion attempts.

Fiber optic view did not differ significantly between the groups. In each group three patients had a score of 2; no score of 1 was found overall.

In a subgroup analysis patients were then divided into an older group (>76 years) and a younger group (≤75 years) {33 vs. 39, respectively}. OLP did not differ between the geriatric and the non-geriatric group (24 vs. 24, respectively ns). Same was found for OLP after 0 min, 15 min and 30 min within the groups (≤75 years vs >76 years, Friedman test; p: 0.572 vs. p: 0.225 respectively). Also, gastric leak pressure and failed insertion did not differ between the groups (**Table 4**).

Type of surgery and position of the patients are shown in **Table 3**.

Discussion

Patient age is continuously increasing and consequently the number of edentulous patients is also increasing [7, 9]. Since implementation of the classical LMA it has been seen that the absence of teeth decreases the performance of laryngeal masks. Even if the development of second generation SGAs and the integration of an elliptic bite block improved the seal and performance of SGAs, this benefit is lost in edentulous geriatric patients [4]. Nevertheless, the use of SGAs in edentulous patients is widely encountered in daily routine.

For the LMA Supreme™ (Teleflex Medical GmbH, Athlone, Co Westmeath, Ireland) in edentulous patients an OLP of 20 cm H_2O was found by Beydes et al. [1]. Considering OLP values of 27 cm H_2O for the same product in patients with teeth, this difference is also of clinical importance [23]. Findings for first generation devices were even more compromising than for second generation devices [11]. Geriatric patients often present reduced lung compliance and are often not sufficiently ventilated when inspiratory pressure has to be limited to 20 cm H_2O due to OLP limitation. In those patients, an SGA failure could necessitate a switch to endotracheal intubation. On the other hand, the use of SGA has some theoretical benefit in older patients as it is associated with less airway morbidity and hemodynamic and catecholamine stress response [12, 19].

In this randomized trial, we wanted to test whether a guided insertion technique using a gastric tube would improve the OLP of the Ambu AuraGain™ by improving the position and reducing the rate of displacement in edentulous patients [6].

Given that we performed our trial at a mixed vascular und visceral surgery facility, our patients were rather old (73 years) and relatively ill (67% ASA III).

We found that the OLP in the Ambu AuraGain™ SGA was 24 cmH_2O in both groups, namely with and without guidance. The OLP of the Ambu AuraGain™ SGA is higher than previously demonstrated for other SGAs (LMA Supreme™ or LMA Unique™) in edentulous patients and should permit wider use in older edentulous patients [1]. Except for insertion time (52 s vs. 26 s guided versus non-guided, respectively p:<0.001), no difference was found in any of the criteria we examined. The significantly longer time for insertion in the guided group can easily be explained by the technique of insertion, as insertion of the gastric tube is time consuming in itself.

The OLP for the Ambu AuraGain™ was seen to be importantly lower than in patients with teeth, where values of 30 cm H_2O were reported [18]. Likewise, a lower insertion success rate was found.

These differences indicate that the changed anatomy of the oropharyngeal space in patients without teeth worsens SGA performance independent of the right position of the SGA as indicated by good results in fiber optic view. One reason for this reduced OLP in this population could be a loss of muscle mass due to geriatric sarcopenia and therefore a reduction of the fit of SGAs within the oropharyngeal cavity [20, 21].

In contrast to Kim et al. we found no difference in OLP between the guided and the non-guided group [15]. Also, no sign of better reliability by the continuous splinting after 15 or 30 min was found within the two groups. This also indicates that the problem is not a displacement after insertion, but there seems to be reduced fit between SGA and oropharyngeal cavity. We then conducted a second analysis by dividing our population into a younger old (<76 years) and an old group (>76 years). Even in this subanal-

ysis OLP did not differ between these two groups and was 24 cm H_2O.

Mean anesthesia duration was relatively long in both groups (149 min vs. 138 min non-guided vs. guided, respectively). Maximum duration was 393 min (non-guided group) and 333 min (guided group), indicating that even for long procedures patients in this special population can be anesthetized with the Ambu AuraGain™.

A small number of laparoscopic interventions ($n = 6$) and in Trendelenburg position ($n = 8$) were also included in this trial. Also, in laparoscopic surgery, we did not find any complications in connection with the premise that the OLP was either ≥ 25 cm H_2O or ≥ 8 cm H_2O above the needed inspiratory airway pressure under normal ventilation before induction of pneumoperitoneum. This is in accordance with current recommendations [24]. As this study did not aim to assess the ventilation efficiency of the Ambu AuraGain™ for laparoscopic surgery, randomized trials for its use in this situation would be necessary to clearly answer this question. A limitation of this trial is that it was not designed to assess OLP of the Ambu AuraGain™ in geriatric (<65 years) patients, so a clear statement of performance can just be done for in older edentulous patients.

Our study has an important limitation. The Ambu AuraGain LMA has a slightly lateral outlet for the gastric tube channel that forces the gastric tube in a slightly left lateral direction, therefore our results may not be comparable to other second generation SGA, such as the Supreme™ LMA.

Conclusion

The Ambu AuraGain™ seems a reliable SGA in older edentulous patients and provides adequate seal for safe ventilation, even in long surgical procedures. A guided insertion technique does not improve OLP or performance of the Ambu AuraGain™ in edentulous patients. As the only difference is an increase in insertion time this technique is of no benefit for this population.

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Compliance with ethical guidelines

Conflict of interest. L. Gasteiger, H. Tauber, C. Velik-Salchner, M. Thoma, R. Fantin, V. Pustilnik, S. Neururer, C. Keller and B. Moser declare that they have no competing interests.

Ethical standards. This report describes human research. IRB contact information: Ethikkommission der Medizinischen Universität Innsbruck—Austria, Christoph-Probst Platz 1, Innrain 52, 6020 Innsbruck mail: i-master@i-med.ac.at, https://www.i-med.ac.at/ethikkommission/index. This study was conducted with written informed consent from the study subjects. The study was conducted according to the Helsinki Declaration. This report describes a prospective randomized clinical trial. The author states that the report includes every item in the CONSORT checklist for a prospective randomised clinical trial. This was not an observational clinical study. This manuscript was screened for plagiarism using Plagiarism Checker.

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