ORIGINAL ARTICLE

Influence of Head and Neck Position on Ventilation Using Three Different Supraglottic Airway Devices (I-Gel, Ambu Auragain, BaskaMask) in Anaesthetized and Paralyzed Patients: A Prospective Randomized Clinical Study

Ravi Sehrawat[1], Shivinder Singh[2], Vikas Chawla[3], Shaleen Trivedi[4], Munish Kumar[4]

ABSTRACT

Background: Supraglottic airway devices play a crucial role in managing the airway during various surgical procedures conducted under general anesthesia. In this study, we evaluated the impact of different head and neck positions (extension, flexion, neutral, and right rotation) on ventilation while using I-gel, Ambu AuraGain, and Baska masks in anesthetized paralyzed patients. **Methodology:** A total of 114 patients were randomly allocated into Group I (n=38) using I-Gel, Group II (n=38) using Ambu AuraGain, and Group III (n=38) using Baska Mask. Clinical performance in terms of OLP (Oropharyngeal Leak Pressure) and anatomical position of the device was evaluated after insertion under general anaesthesia. Ventilation parameters including peak airway pressure, EtCO2 (End-tidal Carbon Dioxide), expiratory tidal volume and ventilation score were assessed at different head and neck positions using three supraglottic airway devices. **Results:** Maximum OLP was observed in Group II and minimum OLP was observed in Group I. In all three devices, OLP was maximum in the flexion position and minimum in the extension position. The Median Brimacombe score was 3 in all three groups at all head and neck positions except at maximum extension in Group I. Although peak airway pressure in Group II is significantly higher than the other two groups, ventilation is not impacted as evidenced by comparable ventilation score, EtCO2 and expiratory tidal volume in all patients of three groups at different head and neck positions. **Conclusion :** To conclude, Ambu Auragain has better anatomical seal at all head and neck positions as compared to I-gel and Baska Mask. However, despite differences in OLP, the ventilatory performances of the three devices were not significantly affected.

KEY WORDS: Ambu Auragain, Baska Mask, I-Gel, Supraglottic Airway Device, Head And Neck Position, Oropharyngeal Leak Pressure.

Introduction

Over the past 25 years, numerous adaptations, enhancements, and alternatives have been introduced in the field of anaesthetic care, specifically pertaining to Supraglottic Airway Devices (SADs)[1]. These devices play a crucial role in managing the airway during surgical procedures conducted under general anesthesia. SADs offer a viable option for tracheal intubation due to their favorable attributes, including stable hemodynamics and reduced airway complications[2].

SADs can be categorized into three main generations: first-generation devices (basic airway tubes),

Access this article online

Quick Response Code:

Website: www.jmsh.ac.in

Doi: 10.46347/jmsh.v10.i1.23.313

[1]Senior Resident (Anaesthesiology), 2254 Field Hospital, [2]Head Quarters Northern Command, Udhampur, [3]Assistant Professor, Dept. of Anaesthesiolgy & Critical Care, Base Hospital, Delhi Cantt, [4]Associate Professor, Dept of Anaesthesiolgy & Critical Care, Command Hospital (CC), Lucknow

Address for correspondence:

Munish Kumar, Associate Professor, Dept of Anaesthesiolgy & Critical Care, Command Hospital (CC), Lucknow. E-mail: drmunishairan@gmail.com

second-generation devices (including a drainage tube), and third- generation devices (featuring a self-energizing sealing mechanism)[3,4]. The Baska mask (Figure 1), a 3rd-generation SAD, has recently gained popularity with patients undergoing ambulatory surgeries and procedures involving pneumoperitoneum as it offers an improved airway seal, especially when combined with intermittent positive pressure ventilation[5,6]. On the other hand, I-gel (Figure 2) is a cuffless device crafted from a thermoplastic elastomer similar to a soft gel and is aimed to establish a close interface with the supraglottic tissues for effective interaction[7]. Another disposable SAD, Ambu AuraGain (Figure 3) is also composed of thermoplastic elastomer and is designed to conform to the airway's anatomy and to provide high sealing pressure[8].

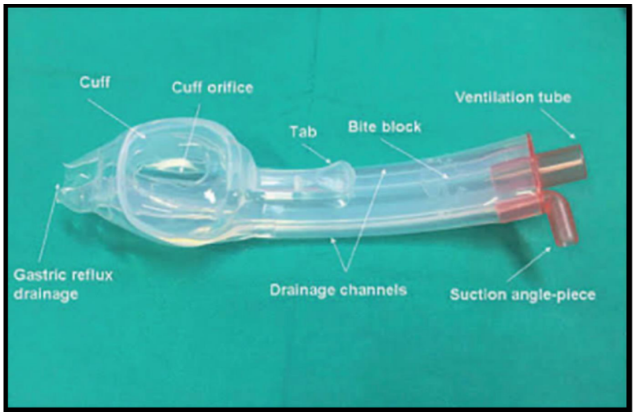

Figure 1: Special Features of Baska Mask

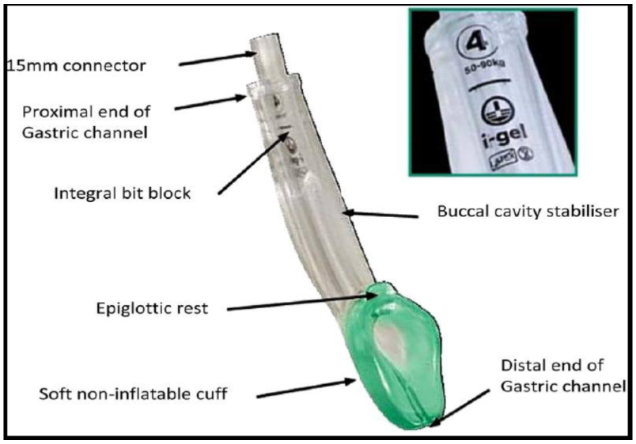

Figure 2: Special Features of I-Gel

SADs have been utilized in patients undergoing various surgeries, adapting to different head and neck positions. The pharyngeal space, both in terms of volume and shape, experiences significant alterations as the head and neck position changes[9]. This change in pharyngeal anatomy affects the performance of SADs in terms of sealing efficacy, ventilation quality and fiber optic visualization[9–11].

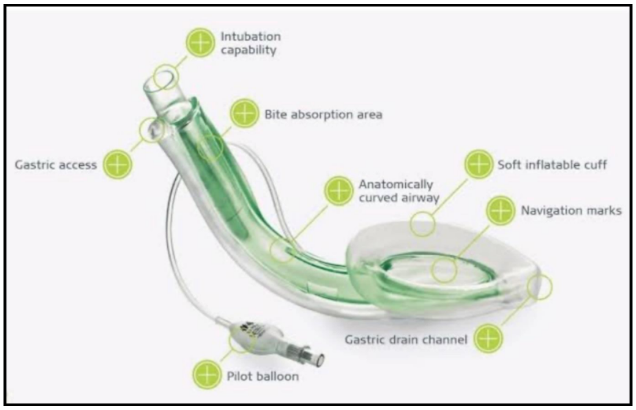

Figure 3: Special Features of Ambu AuraGain

Previously, there have been a limited number of studies examining the impact of head and neck positions on SAD's performance during various surgical procedures, but these studies have presented conflicting results. In this study, our objective was to assess how different head-neck positions (extension, flexion, neutral and right rotation) influence various parameters including OLPs, ventilator score, fibreoptic view of the glottis, peak airway pressure, EtCO2 and expiratory tidal volume. We evaluated these parameters for all three SAD devices (I-gel, Ambu AuraGain, and Baska mask) in anesthetized paralyzed patients.

Methodology

The study was a randomized prospective study carried out at a tertiary-level hospital. Ethical approval was given by the "institutional ethics committee of the hospital. The study included all patients" with age from 18 to 65 years who had ASA ('American Society of Anaesthesiologists') classification I to II and underwent elective surgical procedures under general anaesthesia. Exclusion criteria included patient refusal, BMI ('Body Mass Index') > 40kg/m2, patients with a high risk of regurgitation and aspiration, respiratory tract pathology and surgery lasting more than 02 hours.

A total of 114 patients, who have given informed written consent, were randomly allocated into 3 equal groups. The participants were allocated to respective groups randomly by using Block Randomization (Block of 6). The randomization sequence was generated with the use of online tool (sealed envelope TM) and allocation concealment was done by using opaque envelopes. The envelopes were provided with coding system before the study by the Statistician. All the patients enrolled in the study underwent standard pre-anaesthetic check-up.

Standard monitoring (non-invasive blood pressure, electrocardiography and pulse oximetry) was carried out before the induction of anaesthesia. Standard general anaesthesia was given with intravenous Propofol (1 to 2 mg per kg), Fentanyl (1- 2mcg/kg), and Atracurium (0.5mg/kg). Anaesthesia was kept with an inhalational agent (Sevoflurane) with a mixture of oxygen and air. Ventilatory settings were adjusted to maintain an EtCO2 of 35-40 mmHg. Balanced crystalloid solutions were administered as per the intra-operative requirement.

All patients were positioned supine with their head and neck in a neutral posture without the use of a headrest. The manufacturer's recommendations were followed while determining the SAD's size. SAD was introduced while maintaining the patient's neck flexed and head extended. Head-neck was returned to its neutral position (occiput resting on the operating table) after SAD insertion. The cuff of the cuffed SAD (Ambu AuraGain) was filled with air. Neutral position was maintained with the external ear canal level with the top of the shoulder and the ear eye line (from the external ear canal to the superior orbital margin) being vertical. The patient has been then repositioned into the following positions: flexion (to the maximum extent), extension (to the maximum extent) and maximal rotation to the right. The neutral position served as the starting point for each position shift, and the SAD's depth of insertion was kept constant. Bilateral chest movement on auscultation, a normal capnograph curve and fiberoptic imaging of the glottic aperture were used to determine the correctness of SAD's insertion. Various manipulations, such as gentle pulling or pushing of the device, chin lifts, jaw thrusts, head extension and neck flexion were used in cases of insufficient ventilation. If ventilation did not improve after these techniques, the device was taken out and the patient was intubated with an endotracheal tube.

The ventilation score ranged from 0-3 on the basis of three standards: No airway leakage at a pressure of 15cm of H2O; bilateral chest excursions at a PIP (Peak Inspiratory Pressure) of 20 cm of H2O; and presence of square wave capnogram; every item receiving a score of 0 or 1[12,13]. Therefore, when all three requirements were met, a ventilation score of 3 was obtained. Any adverse event that occurred with the change of position that decreased ventilation was recorded. The device was then brought back to position where there was no compromise in ventilation. Various other ventilatory parameters like peak airway pressure, EtCO2 and expiratory tidal volume were also noted for each device at all head and neck positions.

An independent anaesthesiologist assessed the anatomical position of SAD in each position of the head & neck by fibreoptic evaluation of the glottis, after passing a fibreoptic scope via the airway tube of the device (Figure 4). Brimacombe scoring system was used for the scoring of "fibreoptic view of the glottis (score 1 if the vocal cords are not visible; score 2 if the vocal cords plus anterior epiglottis are visible; score 3 if the vocal cords plus posterior epiglottis are visible; score 4 if only vocal cords are visible)[14,15].

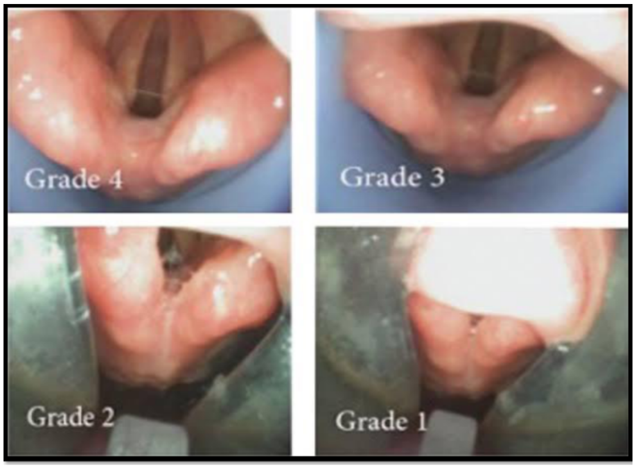

Figure 4: Fibreoptic View of Glottis using Brimacombe Scoring System. (Grade 1 when vocal cords are not visible and Grade 4 when only vocal cords are visible clearly)

OLP or Leak Airway Pressure (LAP) during all positions of head and neck was examined by placing the anaesthesia circle breathing system" in manual or bag mode, with the APL (Adjustable Pressure Limiting) valve closed and a fixed gas flow of 3 liter/minute. Airway pressure was allowed to increase until the leak around the cuff achieved equilibrium, but it was not allowed to go over 40 cm H_2O[16]. This airway pressure at equilibrium was considered as LAP. Any of the approaches like a palpable leak around the cuff; an audible noise above the mouth; or auscultation of noise with a stethoscope placed directly lateral to the thyroid cartilage; was considered for the detection of the leak around the cuff. The differences between the mean leak airway pressure and mean peak airway pressure (LAW-PAW) were also calculated.

Once the patient had recovered consciousness and was responding to verbal orders after reversal of neuromuscular blockade, SAD was withdrawn. Patient was then shifted to the PACU (Post-Anaesthesia Care Unit) and was observed for postoperative recovery.

The sample size was calculated using G Power Analysis software. F test and ANOVA: Fixed Effects, omnibus & A priori analysis were used for Power Calculation.

The standard deviation of leak pressure (SD=6.6) and a clinically relevant change (d) in leak pressure (d=4cm H_2O) from a previous study[9] were taken for calculation of Effect size using below formula:

Effect size= d/S.D. where,

d= clinically meaningful difference

S.D. = Standard Deviation

With the calculated Effect size of 0.36, a level of significance of 5% ($Z\alpha$ indicates normal deviate at a level of significance of 5%, $Z\alpha$= 1.96), power of 90% ($Z1\text{-}\beta$ indicates the normal deviate at a power of 90%, $Z1\text{-}\beta$= 1.28) and number of groups of 3 were considered and entered into G Power. After considering 10% dropout due to methodological difficulties, a total sample of 114 was calculated with 38 patients per group.

Statistical Analysis

Statistical analysis used inferential and descriptive statistics. Mann Whitney U test was applied to compare sample means between 02 independent groups as the dependent variable was either ordinal or continuous, but not normally distributed. Tukey Kramer's HSD (Honest Significant Difference) test, which is a single-step multiple comparison procedure and statistical test, was applied to assess the significance of variations between pairs of group means. Advantage of using this test is to keep the level of the Type I error (i.e., finding a difference when none exists) equal to the chosen alpha level and also to allow the computation of confidence intervals for the differences between the means. The Kruskal – Wallis test was used to evaluate the significance of variations between pairs of group medians. This test was used for the purpose of comparison for the outcomes of three non-identical groups.

The P-value was considered significant at a confidence level of 95%. Continuous (real- valued) parameters were noted as mean ± SD (Standard Deviation) and categorical parameters were presented as percentage (%) and number. SPSS 24.0 software was taken into account for "statistical analysis".

Results

A total of 114 patients were evaluated for eligibility and recruited for the study. Patients were then allocated randomly into Group I (n=38) using I-Gel, Group II (n=38) using Ambu AuraGain, and Group III (n=38) using Baska Mask. One patient of Group I and 03 patients of each Group II and Group III underwent endotracheal intubation & were excluded from the analysis.

Demographic characteristics of all patients were revealed in Table 1. There was no statistically substantial variation between the 03 groups regarding confounding factors like age, sex, ASA class & BMI.

In all the positions (neutral, maximum flexion, maximum extension, right rotation), maximum OLP was observed in Group II and minimum OLP was observed in Group I (Table 2). As concerned for the type of positions, maximum OLP was noticed in the flexion position, and minimum OLP was noticed in the extension position in all three devices.

'Between-group differences' of OLP in different positions showed that in all the positions Group II had significantly higher OLP than Group I and III (Table 2). Between Group I and Group III, significant differences in OLP were observed in neutral (p=0.032) and maximum flexion (p=0.030) positions only. The ventilation score of all the patients in all the positions was 3.

Median Brimacombe score of all patients of the three groups was 3 in all the positions except at maximum extension in Group I, where we observed median Brimacombe score of 4 (Table 3). On comparing the 'between-group differences' of Brimacombe score,

Table 1: Intergroup Comparison of Demographic Profile

Characteristics	Group I (n=38)		Group II (n=38)		Group III (n=38)		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	F	'p'
Age (years)	44.24	13.00	47.68	13.68	44.00	12.38	0.951	0.389
Weight (kg)	69.03	6.64	72.45	6.30	71.66	6.37	2.943	0.057
BMI (kg/m^2)	24.32	3.28	24.21	2.83	23.84	3.17	0.245	0.783
Gender	**Number**	**%**	**Number**	**%**	**Number**	**%**	**F**	**'p'**
Female	23	60.5	23	60.5	19	50.0	1.145	0.564
Male	15	39.5	15	39.5	19	50.0		
ASA Grade	**Number**	**%**	**Number**	**%**	**Number**	**%**	**F**	**'p'**
Grade I	24	63.2	20	52.6	18	47.4	1.980	0.372
Grade II	14	36.8	18	47.4	20	52.6		

BMI: Body Mass Index, ASA: American Society of Anaesthesiologists, P<0.05 was considered significant.

Table 2: Comparison of Oropharyngeal Leak Pressure (OLP) in Different Positions

Intergroup Comparison (ANOVA)

Position	Group I (n=37)		Group II (n=35)		Group III (n=35)		ANOVA	
	Mean	SD	Mean	SD	Mean	SD	F	'p'
Neutral	28.05	3.02	34.94	3.22	30.20	4.34	34.983	**<0.001**
Flexion	31.65	3.43	36.74	3.02	33.91	4.55	16.895	**<0.001**
Extension	23.81	3.84	31.57	3.63	25.97	4.38	36.527	**<0.001**
Right rotation	27.81	2.89	34.69	3.42	29.40	4.18	37.138	**<0.001**

Between Group Comparison (Tukey Kramer's HSD)

Position	Group I vs II			Group I vs III			Group II vs III		
	Mean Diff	SE	'p'	Mean Diff	SE	'p'	Mean Diff	SE	'p'
Neutral	-6.89	0.84	**<0.001**	-2.15	0.84	0.032	4.74	0.85	**<0.001**
Flexion	-5.09	0.88	**<0.001**	-2.27	0.88	0.030	2.83	0.89	**0.005**
Extension	-7.76	0.93	**<0.001**	-2.16	0.93	0.058	5.60	0.95	**<0.001**
Right Rotation	-6.87	0.83	**<0.001**	-1.59	0.83	0.140	5.29	0.84	**<0.001**

P<0.05 was considered significant.

these differences were not significant at any of the positions (Table 3).

Expiratory tidal volume remained constant in all the positions (Table 4). However, the 'peak airway pressure' of Group II was significantly greater than that of Group I and III in all positions (Table 4). LAW-PAW of Group II was highest followed by that of Group III and a minimum of Group I. These differences in LAW-PAW of all three groups were significant ($p<0.05$) in all the positions (Table 4).

'Between-group differences' of expiratory tidal volume did not show any significant difference in all the positions (Table 5). Peak airway pressure of Group II was significantly greater than that of Group I and Group III in all the positions except in maximum extension ($p=0.40$). EtCO2 of the three groups was comparable in all the positions except in maximum flexion (Table 5). Group III had significantly higher EtCO2 than Group II in maximal flexion ($p=0.024$).

On comparing the 'between-group differences', Group I and Group III had comparable LAW-PAW

Table 3: Comparison of Brimacombe Score in Different Positions

Intergroup Comparison (Kruskal-Wallis test)								
Position	Group I (n=37)		Group II (n=35)		Group III (n=35)		Kruskal-Wallis test	
	Mdn/Mean	SD	Mdn/Mean	SD	Mdn/Mean	SD	H	'p'
Neutral	3.00/3.03	0.87	3.00/2.89	0.83	3.00/2.94	0.87	0.748	0.688
Flexion	3.00/2.84	0.76	3.00/2.71	0.83	3.00/2.74	0.95	0.723	0.697
Extension	4.00/3.27	0.90	3.00/3.14	0.81	3.00/3.06	0.87	1.597	0.450
Right Rotation	3.00/3.03	0.87	3.00/2.91	0.82	3.00/2.94	0.87	0.574	0.751

Between Group Comparison (Mann Whitney U test)						
Position	Group I vs II		Group I vs III		Group II vs III	
	Z	'p'	Z	'p'	Z	'p'
Neutral	0.879	0.379	0.558	0.577	0.218	0.827
Flexion	0.887	0.375	0.564	0.573	0.136	0.892
Extension	0.904	0.366	1.188	0.235	0.394	0.694
Right Rotation	0.743	0.458	0.558	0.577	0.075	0.940

Mdn - Median
P<0.05 was considered significant.

Table 4: Intergroup Comparison of Ventilatory Parameters in Different Positions

Position	**Group I (n=37)**		**Group II (n=35)**		**Group III (n=35)**		**ANOVA**	
	Mean	**SD**	**Mean**	**SD**	**Mean**	**SD**	**F**	**'p'**
Expiratory Tidal Volume								
Neutral	685.68	64.36	720.29	65.01	705.71	69.04	2.491	0.088
Flexion	685.68	64.36	720.29	65.01	705.71	69.04	2.491	0.088
Extension	685.68	64.36	720.29	65.01	705.71	69.04	2.491	0.088
Right Rotation	685.68	64.36	720.29	65.01	705.71	69.04	2.491	0.088
Peak Airway Pressure								
Neutral	19.22	1.92	21.03	1.54	19.49	1.27	13.172	**<0.001**
Flexion	21.78	2.41	23.20	2.72	21.17	2.37	6.066	**0.003**
Extension	17.54	2.05	18.69	1.55	18.14	1.59	3.853	**0.024**
Right Rotation	19.65	2.19	20.74	1.38	19.40	1.80	5.369	**0.006**
End Tidal Carbon Dioxide								
Neutral	37.08	1.06	36.83	1.20	37.34	1.06	1.886	0.157
Flexion	37.43	1.09	37.26	1.40	38.03	1.12	3.910	**0.023**
Extension	36.70	1.08	36.20	0.93	36.60	1.14	2.255	0.110
Right Rotation	36.92	0.98	36.77	0.91	36.89	0.99	0.230	0.795
Leak Airway Pressure-Peak Airway Pressure (LAW-PAW)								
Neutral	8.84	3.15	13.94	3.46	10.71	3.87	19.514	**<0.001**
Flexion	10.03	4.71	13.83	3.98	12.74	4.25	7.395	**0.001**
Extension	6.32	4.06	12.83	3.91	7.83	3.97	26.019	**<0.001**
Right Rotation	8.11	3.32	13.94	3.68	10.03	3.85	24.160	**<0.001**

P<0.05 was considered significant.

in all the positions except in maximum flexion (p=0.024). LAW-PAW of Group II was significantly greater than Group I in all the positions (Table 5). Group III had significantly less LAW-PAW than Group II at neutral, maximum extension and right rotation positions (Table 5).

Discussion

Considering the fact that airway devices as well as head positioning could affect the performance of an airway device, the current analysis was planned to compare the OLPs, ventilator score, and fiberoptic view of glottis of three SADs, viz.I-gel, Ambu AuraGain and Baska mask, in different positions of head and neck, such as extension, flexion, neutral and right rotation.

In the present study, for all three devices, OLP was minimum in the extension position and maximum in the flexion position. Amongst the three devices, Ambu AuraGain tended to have significantly the highest leak pressure and I-gel tended to have significantly the lowest OLP. The maximum difference in leak pressure was seen between I-gel and Ambu AuraGain for the extension position while the minimum difference was seen between Baska mask and I-gel for the right rotation position. Extension position traditionally has been reported to have minimum OLP while flexion position has been reported to generate maximum OLP for different supraglottic devices. Sanuki et al also found that leak pressure was lower in the extension position (23.0 ± 4.2 cm $H2O$, P=0.015) and was higher in the flexion position (28.5 ± 3.4 cm $H2O$, P=0.015) in comparison to neutral position while using I-gel in paralyzed patients planned for oral surgery[13]. They also found neutral and rotation positions to lie in between these two extremes as observed in the present study. Similar observations were also made by other workers for different devices used[10,16–18].

In the present study, we found leak pressure to be significantly higher in Ambu AuraGain than in I-gel and Baska mask in different positions. Similar to these findings, Pradeep et al also found Ambu AuraGain to have significantly greater leak pressure as compared to I-gel[19]. In the present study, though we did not find a significant variation between I-gel and Baska mask groups w.r.t. leak pressure in extension and right rotation positions, however, for neutral and flexion positions Baska mask had significantly higher leak pressure as compared to I-gel. Thus, in relative terms, Ambu AuraGain offered maximum leak pressure followed by Baska mask and I-gel respectively. There is limited literature showing the comparison between efficacy of Baska mask and of Ambu AuraGain, however, many studies have compared i-gel with Baska mask and found Baska mask to be better than I-gel[6,18].

The better performance of Ambu AuraGain over the other two devices could be attributed to its special curved design that conforms better to the anatomy of the airway. The wider size of the airway tube and prominence of the posterior cuff provide a more tighter and consistent perilaryngeal seal with Ambu AuraGain. However, this better performance of Ambu AuraGain could be dependent on the patient's age too. Kim et al[20] in their study on young pediatric patients compared I-gel and Ambu AuraGain and found OLP to be significantly higher in I-gel as compared to Ambu AuraGain which is in contrast with the findings of the present study. However comparative studies between I- gel and Ambu AuraGain conducted in adults show results similar to that obtained in the present study[19,21]. One of the reasons for age-dependent differences in the performance of Ambu AurGain could be the anatomical differences in the airways of children and adults.

In the present study, all the patients in all three groups had a ventilation score of 3 irrespective of the head-neck position. Findings of the analysis showed that despite slight differences in leak pressure among the three groups, all of them provided safe airway and had a stable airway profile at all head and neck positions.

No significant differences among the three SADs were observed from a visualization point of view at different head and neck positions. SADs are known to have the least interference with the laryngeal view owing to their extraglottic nature. None of the previous studies have reported visualization issues with any of the three SADs being evaluated in this study.

The expiratory tidal volume remained stable in each group irrespective of position. Peak airway pressure also showed similar trends as observed for OLP, both with respect to head and neck positions and intergroup differences. Ambu AuraGain had significantly higher peak airway pressure as compared to I-gel and Baska mask for flexion, neutral, and rotation positions. Nevertheless, the high leak

Table 5: Between

Position	Group I vs II			Group I vs III			Group II vs III		
	Mean diff.	SE	'p'	Mean diff.	SE	'p'	Mean diff.	SE	'p'
Expiratory Tidal Volume									
Neutral	-34.61	15.59	0.073	-20.04	15.59	0.407	14.57	15.81	0.628
Flexion	-34.61	15.59	0.073	-20.04	15.59	0.407	14.57	15.81	0.628
Extension	-34.61	15.59	0.073	-20.04	15.59	0.407	14.57	15.81	0.628
Right Rotation	-34.61	15.59	0.073	-20.04	15.59	0.407	14.57	15.81	0.628
Peak Airway Pressure									
Neutral	-1.81	0.38	**<0.001**	-0.27	0.38	0.757	1.54	0.38	**<0.001**
Flexion	-1.42	0.59	**0.047**	0.61	0.59	0.555	2.03	0.60	**0.003**
Extension	-1.15	0.41	**0.018**	-0.60	0.41	0.315	0.54	0.42	0.400
Right Rotation	-1.09	0.43	**0.033**	0.25	0.43	0.833	1.34	0.44	**0.008**
End Tidal Carbon Dioxide									
Neutral	0.25	0.26	0.599	-0.26	0.26	0.577	-0.51	0.26	0.132
Flexion	0.18	0.29	0.813	-0.60	0.29	0.098	-0.77	0.29	**0.024**
Extension	0.50	0.25	0.112	0.10	0.25	0.910	-0.40	0.25	0.256
Right Rotation	0.15	0.23	0.793	0.03	0.23	0.988	-0.11	0.23	0.873
Leak Airway Pressure- Peak Airway Pressure (LAW-PAW)									
Neutral	-5.11	0.82	**<0.001**	-1.88	0.82	0.064	3.23	0.84	**0.001**
Flexion	-3.80	1.02	**0.001**	-2.72	1.02	**0.024**	1.09	1.04	0.548
Extension	-6.50	0.94	**<0.001**	-1.50	0.94	0.250	5.00	0.95	**<0.001**
Right Rotation	-5.83	0.85	**<0.001**	-1.92	0.85	0.067	3.91	0.86	**<0.001**

P<0.05 was considered significant.

pressure of Ambu AuraGain was advantageous for the achievement of comparable ventilation, in spite of high peak airway pressure.

In the present study, end-tidal CO2 levels in general remained well-controlled and did not show any significant intergroup or inter-head and neck position difference except for a difference between Ambu AuraGain and Baska mask for flexion position with mean value in the Ambu AuraGain group being significantly lower than in Baska mask group. On reviewing the related literature, we did not find any study reporting the effect of SGA devices on the end-tidal CO2 levels at different head and neck positions and may set aside this finding as an incidental finding only that needs further exploration in subsequent studies.

The findings of our analysis should be contemplated in the light of a few limitations. First, the investigator involved in the insertion and removal of the device could not be blinded. As all the determined parameters have been clearly described in the study, findings were unlikely to have skewed owing to unblinding. Secondly, other considerations such as ease of insertion, number of attempts, and adverse effects were not taken into consideration. More studies to corroborate and validate the findings of the present study are recommended.

Conclusion

We conclude that Ambu AuraGain is the most suitable airway device for supraglottic airway management owing to its better anatomical adaptation resulting in a better seal as compared to I-gel and Baska mask. The performance of I-gel and Baska mask was almost comparable but Baska mask had a slight edge over I-gel. However, inspite of differences in OLP, the ventilatory performance of the three devices was not significantly affected. Since the present study is one of the first studies comparing the performance of these three supraglottic airway devices, results should be warranted in further studies for verification and validation.

References

1. Singh K. Second generation Supraglottic Airway (SGA) devices. In: Special considerations in human airway management. . Available from: https://doi.org/10.5772/intechopen.93947.
2. Dhanda A, Singh S, Bhalotra AR, Chavali S. Clinical Comparison of I-Gel Supraglottic Airway Device and Cuffed Endotracheal Tube for Pressure-Controlled Ventilation During Routine Surgical Procedures. Turkish Journal of Anesthesia and Reanimation. 2017;45(5):270–276. Available from: https://doi.org/10.5152/TJAR.2017.44711.
3. Timmermann A, Bergner UA, Russo SG. Laryngeal mask airway indications: new frontiers for second-generation supraglottic airways. Curr Opin Anaesthesiol. 2015;28(6):717–743. Available from: https://doi.org/10.1097/ACO.0000000000000262.
4. Singh A, Lalit G. Supraglottic Airway Devices: A Knock of Future. Anaesthesia & Critical Care Medicine Journal. 2018;3(1):1–7. Available from: https://medwinpublishers.com/ACCMJ/ACCMJ16000129.pdf.
5. Zundert T, Gatt S, Zundert TV, S G. The Baska Mask -A new concept in self- sealing membrane cuff extraglottic airway devices, using a sump and two gastric drains: A critical evaluation. J Obstet Anaesth Crit Care. 2012;2(1). Available from: https://doi.org/10.4103/2249-4472.99313.
6. Choi SR, Lee TY, Kim SW, Park SY, Chung CJ, Kim JH. Comparison of clinical performance of i-gel*rcledR*; and Baska Mask*rcledR*; during laparoscopic cholecystectomy. Korean Journal of Anesthesiology. 2019;72(6):576–582. Available from: https://doi.org/10.4097/kja.19195.
7. Theiler L, Gutzmann M, Kleine-Brueggeney M, Urwyler N, Kaempfen B, Greif R. i-gel^{TM} supraglottic airway in clinical practice: a prospective observational multicentre study. British Journal of Anaesthesia. 2012;109(6):990–995. Available from: https://doi.org/10.1093/bja/aes309.
8. Zaballos M, Escribá F, López S, Zaballos J, Montero J, Fernández I. A multicenter and observational study of the Ambu AuraGain laryngeal mask in adult patients. Rev Esp Anestesiol Reanim (Engl Ed). 2021;68(2):73–81. Available from: https://doi.org/10.1016/j.redar.2020.08.014.
9. Kim MSS, Park JH, Lee KYY, Choi SH, Jung HH, Kim JHS, et al. Influence of head and neck position on the performance of supraglottic airway devices: A systematic review and meta-analysis. PLOS ONE. 2019;14(5):e0216673–e0216673. Available from: https://doi.org/10.1371/journal.pone.0216673.
10. Kim HJ, Lee K, Bai S, Kim MH, Oh E, Yoo YC. Influence of head and neck position on ventilation using the air-Q® SP airway in anaesthetized paralysed patients: a prospective randomized crossover study. British Journal of Anaesthesia. 2017;118(3):452–457. Available from: https://doi.org/10.1093/bja/aew448.
11. Keller C, Brimacombe J. The Influence of Head and Neck Position on Oropharyngeal Leak Pressure and Cuff Position with the Flexible and the Standard Laryngeal Mask Airway. Anesthesia & Analgesia. 1999;88(4):913–916. Available from: https://doi.org/10.1097/00000539-199904000-00042.
12. Kim JT, Jeon SY, Kim CS, Kim SD, Kim HS. Alternative method for predicting optimal insertion depth of the laryngeal tube in children. British Journal of Anaesthesia. 2007;99(5):704–707. Available from: https://doi.org/10.1093/bja/aem241.
13. Sanuki T, Uda R, Sugioka S, Daigo E, Son H, Akatsuka M, et al. The influence of head and neck position on ventilation with the i-gel airway in paralysed, anaesthetised patients. European Journal of Anaesthesiology. 2011;28(8):597–599. Available from: https://doi.org/10.1097/EJA.0b013e32834698f4.
14. Brimacombe J, Berry A. A proposed fiber-optic scoring system to standardize the assessment of laryngeal mask airway position. Anesth Analg. 1993;76(2):457. Available from: https://pubmed.ncbi.nlm.nih.gov/8424538/.
15. Keller C, Brimacombe J, Pühringer F. A Fibreoptic Scoring System to Assess the Position of Laryngeal Mask Airway Devices. Interobserver Variability and a Comparison Between the Standard, Flexible and Intubating Laryngeal Mask Airways. ains · Anästhesiologie · Intensivmedizin · Notfallmedizin · Schmerztherapie. 2000;35(11):692–694. Available from: https://doi.org/10.1055/s-2000-8164.
16. Ra-R AA, Osman YM. Evaluation of head and neck position on oropharyngeal leak pressure with Baska mask and Streamlined Liner of Pharyngeal Airway (SLIPA): A randomized Clinical Trial. Int J Anesth Clin Med. 2017;5:36–41. Available from: https://doi.org/10.11648/j.ja.20170505.11.
17. Jain D, Ghai B, Bala I, Gandhi K, Banerjee G. Evaluation of I-gel^{TM} airway in different head and neck positions in anesthetized paralyzed children. Pediatric Anesthesia. 2015;25(12):1248–1253. Available from: https://doi.org/10.1111/pan.12748.
18. Sidhu GK, Jindal S, Mahajan R, Bhagat S. Influence of head and neck positions on oropharyngeal seal pressure with Baska mask versus I-gelTM; A randomised clinical study. Indian J Anaesth. 2020;64(8):675–80. Available from: https://doi.org/10.4103/ija.IJA_185_20.
19. Pradeep MS, Nandanwankar NK, Lahane PV, Memon NY, Yennawar SD, Pathak RG. A Randomised comparison and evaluation of I-gel, Supreme laryngeal

mask airway and Ambu Auragain in Laparoscopic surgeries under general anaesthesia with controlled ventilation. Asian Journal of Medical Sciences. 2021;12(4):68–75. Available from: https://doi.org/10.3126/ajms.v12i4.32931.

20. Kim HJJ, Park HSS, Kim SYJ, Ro YJJ, Yang HSS, Koh WU. A Randomized Controlled Trial Comparing Ambu AuraGain and i-gel in Young Pediatric Patients. Journal of Clinical Medicine. 2019;8(8):1235–1235. Available from: https://doi.org/10.3390/jcm8081235.
21. Lakshmi TC, Tiwari T, Agrawal J, Kapoor R, Vasanthakumar V. Comparison of the clinical performance of the i-gelTM, LMA SupremeTM, and Ambu AuraGainTM in adult patients during general anesthesia: a prospective and randomized study. Korean Journal of Anesthesiology. 2022;75(4):316–322. Available from: https://doi.org/10.4097/kja.21212.

How to cite this article: Sehrawat R, Singh S, Chawla V, Trivedi S, Kumar M. Influence of Head and Neck Position on Ventilation Using Three Different Supraglottic Airway Devices (I-Gel, Ambu Auragain, BaskaMask) in Anaesthetized and Paralyzed Patients: A Prospective Randomized Clinical Study. J Med Sci Health 2024; 10(1):86-95

Date of submission: 25.09.2023
Date of review: 19.10.2023
Date of acceptance: 11.01.2024
Date of publication: 22.04.2024