Original Article

Effect of Head and Neck Positions on Oropharyngeal Seal Pressure with Baska Mask Versus I- Gel: A Prospective Randomized Interventional Study

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ABSTRACT

Introduction: Airway management is a crucial skill for clinical anaesthesiologists. It is an integral part of general anesthesia, allowing ventilation and oxygenation as well as a mode of anesthetic gas delivery. This study was aimed to compare oropharyngeal seal pressure, peak inspiratory pressure, and exhaled tidal volume in different head and neck positions between two different groups using Baska mask and I-gel in paralyzed adult patients.

Methodology: The study population (n=100) was randomly divided into two groups by opaque sealed envelope technique. Group A (n=50) received Baska mask and group B (n=50) received I-gel. Calculated volume of intravenous fluids was started through intravenous line secured with 18G cannula at 8 ml/kg body weight. Anaesthesia was induced in supine position with the patient's head in neutral position, resting on a roll sheet under shoulder. Oropharyngeal seal pressure (OSP) was measured by closing the expiratory valve of the circle system at a fixed gas flow of 3 L/minutes and noting the airway pressure at which equilibrium was reached.

Results: Mean oropharyngeal seal pressure at different head and neck position among cases of Baska mask group was higher than cases of I-gel group and this difference in mean oropharyngeal seal pressure at different head and neck position was found to be statistically significant (p value <0.05).

Conclusion: Baska mask and I-gel have comparable insertion success rates, insertion time, number of attempts for insertion, ease of insertion, and stable haemodynamic parameters. Hence, both I-gel and Baska mask can be used as ventilatory devices in anesthetized and paralyzed patients.

Keywords: Baska mask, I-gel, Neck position, Oropharyngeal seal pressure.

INTRODUCTION

Airway management is a crucial skill for clinical anaesthesiologists. It is an integral part of general anaesthesia allowing ventilation and oxygenation as well as a mode of anaesthetic gas delivery. Supraglottic airway devices (SADs) are used to keep the upper airway open to provide unobstructed ventilation. Dr Archie Brain's laryngeal mask airway (LMA), a supraglottic device introduced in 1981 made a revolution in the management of airway, replacing the most commonly used endotracheal tubes for general anaesthesia by negating the need for laryngoscopy and sometimes muscle relaxants.[1] A potential risk of SAD use is incomplete airway sealing, which may cause gastric insufflation at pressures above 20 cm H_2O by opening the oesophageal sphincter.[2] The newer SADs are designed to decrease the risk of aspiration and to increase the oropharyngeal leak pressure (OLP), improving the airway seal at higher airway pressures during intermittent positive pressure ventilation without significant gastric inflation.[3] SADs are mostly useful in difficult airway scenarios like edentulous patients, facial injuries, facial contour not suiting face masks, and facial burns without upper airways burn.[4,5] They provide rapid access to the airway in emergency situations as well as in 'can't intubate can't face mask ventilate' situations. It also facilitates passage for tracheal tube and plays a vital role in difficult algorithm in case of the anticipated and unanticipated difficult airway.[6] SADs are associated with minimal cardiovascular responses during insertion and fewer postoperative oropharyngeal morbidities.[7,8]

The main problems encountered with first generation supraglottic airway devices is lower seal pressure leading to ineffective ventilation when higher airway pressures are required such as in patients with low lung compliance, and they provide no protection from gastric regurgitation and aspiration. Proseal LMA, I- Gel, Supreme LMA have a

gastric channel to drain the gastric fluid thereby reducing the chances of aspiration.[9] Third generation supraglottic airway devices including Baska mask incorporate the features of 2nd generation LMA with additional feature that provide a higher seal pressure than other LMAs as during IPPV the seal apposes to the glottis incrementally to augment the seal pressure with increasing airway pressure, thus making it different from other non inflatable cuff devices like I-gel.[10,11] The primary objective of the present study was to determine the difference in mean of oropharyngeal seal pressure (OSP) at different head and neck positions in two groups using Baska mask and I-gel.

METHODS

This hospital based prospective randomized interventional study was done on 100 patients of either sex, ASA grade I and II, aged 18-60 years, weighing 50-80 kg with body mass index (BMI) < 35 kg/m^2, posted for surgical procedures of less than 2 hours duration under general anesthesia using supra glottic airways device. Institutional ethics committee approval was obtained (No.1087/MC/EC/2021) and study was also registered under CTRI vide No. CTRI/2022/12/048557. Study population was randomized by opaque sealed envelope technique and divided into two groups. Group A (n=50) received Baska mask and group B (n=50) received I-gel as an airway device. Calculated volume of intravenous fluids was started through IV line secured with 18G cannula at 8 ml/kg body weight. Anaesthesia was induced in supine position with the patient's head in neutral position, resting on a roll sheet under shoulder. After preoxygenation with 100% oxygen for 3 minutes, premedication was given as injection Midazolam 0.05 mg/kg and injection Glycopyrolate 5 µg/kg and injection Fentanyl 2 µg/kg. Induction was achieved by injection Propofol 2.5 mg/kg i.v. and injection Succinylcholine 1.5 mg/kg to facilitate neuromuscular blockade.

Patient was ventilated for one minute. Anaesthesia was considered acceptable for device insertion when the patient did not respond to the verbal command with complete

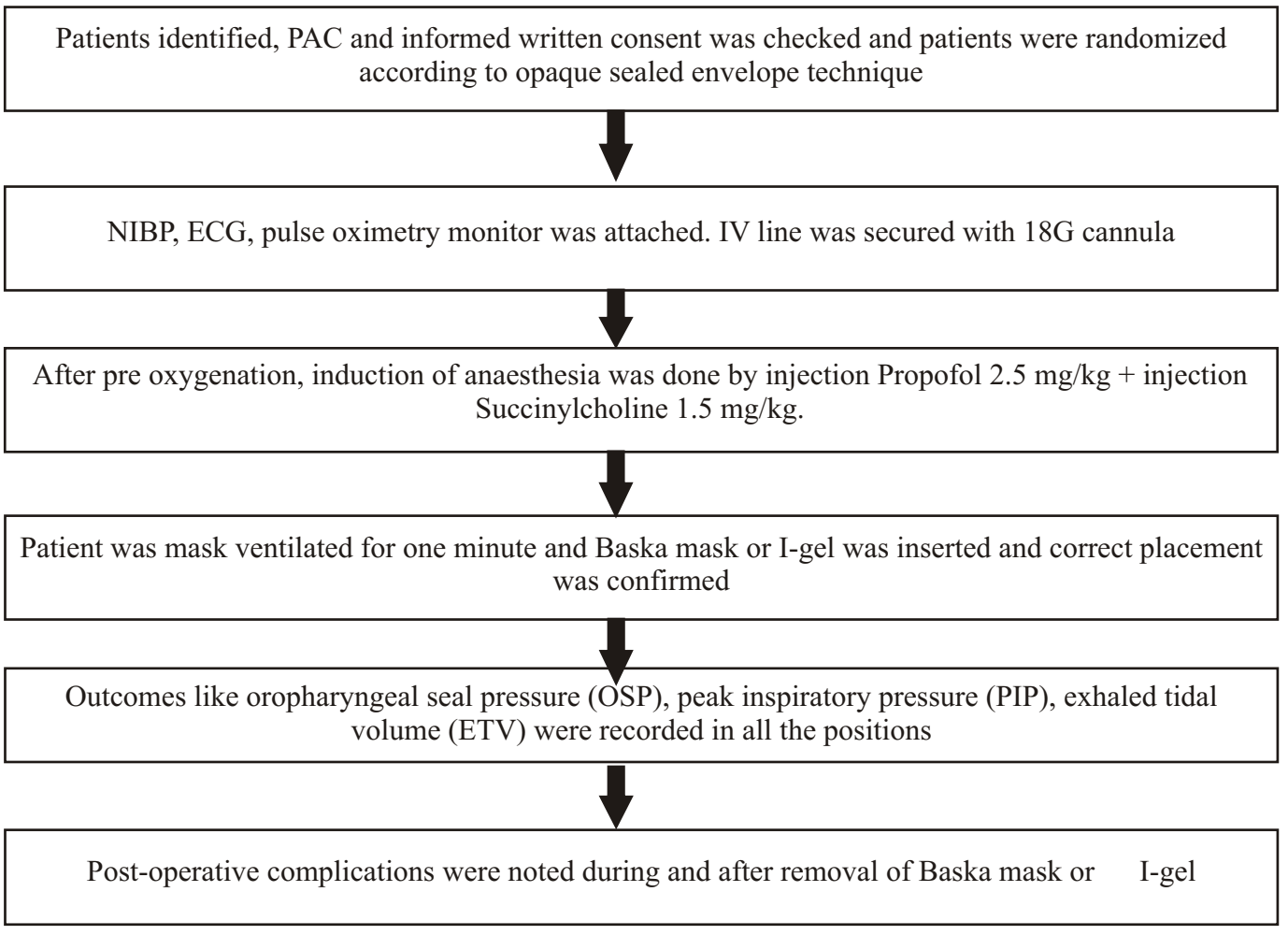

Figure 1: Flow diagram of the procedure.

neuromuscular relaxation. Baska mask or I-gel was thoroughly checked for their function and integrity after removal from their respective sterile pack. Size 3 and 4 of I-gel were used for patients weighing less than 50 kilogram and between 50 to 90 kilogram, respectively. Size 4 and 5 of Baska masks were used for patients weighing between 50 to 70 kilogram and >70 kilogram, respectively. Effective ventilation was considered as SpO_2>95%, $ETCO_2$ <40 mm Hg, and tidal volume >6 ml/ kg. At the end of the surgery, the SADs were removed when protective reflexes returned to normal. The number of attempts required for insertion were recorded and failed attempts were considered as the removal of the device from the mouth. A maximum of three attempts were allowed and after that endotracheal tube was inserted for airway management and the patient was excluded from the study.

Oropharyngeal seal pressure (OSP) was measured by closing the expiratory valve of the circle system at a fixed gas flow of 3 L/min and noting the airway pressure (maximum allowed was 40 cm of H_2O) at which equilibrium was reached. The inter observer reliability and accuracy of this measuring system has already been validated.[12] The success of insertion was assessed by the number of insertion attempts (counted when Baska mask and I-gel was taken in and out of a mouth). Ease of insertion was qualitatively evaluated using four-point scale (i- No resistance, ii- Mild resistance, iii-Moderate resistance, and iv- Unable to place). The insertion time (the time between picking up the prepared mask and successful placement) was assessed in all the cases. The anatomical placement of both the devices in-situ was assessed clinically in neutral position. The neutral position was maintained with the external auditory canal level with the top of the shoulder and the ear line (from the external ear to the superior orbital margin) vertical.

Oropharyngeal seal pressure (OSP), peak inspiratory pressure (PIP), exhaled tidal volume (ETV), and $ETCO_2$ were recorded in the neutral position. Then the patient was repositioned in the following positions: maximal extension which was achieved by extending neck till resistance was felt, maximal flexion (about 45° each) which was obtained by flexing the neck at a point when chin touches sternum and maximal rotation to the left or right (about 90°) as noted preoperatively. Each position change was started from a neutral position after 30-60 seconds of the stable period and the depth of insertion of the SAD was constantly maintained as in neutral position. The readings of OSP, PIP, ETV, and $ETCO_2$ were taken one minute after head and neck positions before the start of surgery. Any complication in the intraoperative period and manipulation to correct the use of the supraglottic device were also documented. The device was thoroughly checked for its integrity and shape at time of removal.

Data were entered in the excel sheet. Quantitative data were expressed as mean±standard deviation (SD). Qualitative data was expressed as frequency and percentage. Independent sample t test of significance was used when comparing between two means (quantitative data). Chi-square (χ^2) test of significance was used to compare proportions between qualitative parameters. The confidence interval was set to 95%, and the margin of error accepted at 5%. The p value ≤0.05 was considered significant.

RESULTS

Both the groups were comparable and there was no statistically significant difference with regards to mean age, sex, and body weight of the patients. Also, comparable with respect to Mallampatti grade, ASA physical status, thyromental distance, and inter-incisor distance among patients. In the Baska mask group, the majority cases (43,86%) had Mallampatti grade 2 and the rest cases (7, 14%) had Mallampatti grade 1. Similarly, in the I-gel group, most cases (45, 90%) had Mallampatti grade 2 and the rest cases (5,10%) had Mallampatti grade 1. In Baska mask group, majority cases (44, 88%) had ASA grade 1 and rest cases (6, 12%) had ASA grade 2. While in the I-gel group, (42, 84%) had ASA grade 1 and the remaining (8, 16%) cases had ASA grade 2. Difference in the Mallampatti grade and ASA grade of cases between both the study groups was found to be statistically insignificant. In the Baska mask group, almost half (54%, 27/50) cases had 6 cm thyromental distance, followed by 6.5 cm in 18(36%) cases and the remaining five (10%) cases had >6.5 cm thyromental distance. In the I-gel group, 32 (64%) cases had 6 cm thyromental distance, followed by 6.5 cm in 15 (30%) cases and the remaining three (6%) cases had >6.5 cm thyromental distance. In the Baska mask group, the majority cases (39, 78%) had 3 cm of interincisor distance and the rest cases (11, 22%) had 2.5 cm of inter-incisor distance. Similarly, in the I-gel group, most cases (41, 82%) had 3 cm of inter-incisor distance and the rest nine cases (18%) had 2.5 cm of inter-incisor distance.

In the Baska mask group, the majority (44, 88%) had one attempt for insertion and the remaining six (12%) cases had two attempts for insertion. Similarly, in the I-gel group,

Table 1: Mean oropharyngeal seal pressure, mean peak inspiratory pressure, and mean exhaled tidal volume in study participants

Variable		Baska mask Mean ± SD	I-gel Mean ± SD	p value
	N	31.04 ± 2.17	24 ± 1.81	<0.001
OSP (cm H_2O)	N-F	33.52± 1.74	26.3 ± 1.98	<0.001
	N-E	28.82 ±2.04	21.96 ± 1.86	<0.001
	N-RL	30.64 ± 2.04	23.46 ± 1.69	<0.001
	N-LL	30.74 ± 2.04	23.36 ± 1.84	<0.001
PIP (cm H_2O)	N	12.34 ± 1.06	11.92 ± 1.18	0.064
	N-F	15.92 ± 1.29	16.66 ± 1.39	0.007
	N-E	8.96 ± 1.19	8.64 ± 0.98	0.145
	N-RL	12.98 ± 0.98	12.64 ± 1.03	0.094
	N-LL	12.94 ± 0.79	12.62 ± 0.97	0.073
ETV (ml/kg)	N	7.31 ± 0.38	7.12 ± 0.22	0.003
	N-F	5.67 ± 0.37	5.1 ± 0.33	<0.001
	N-E	8.21 ± 0.62	8.26 ± 0.39	0.608
	N-RL	7.25 ± 0.38	7.22 ± 0.31	0.587
	N-LL	7.23 ± 0.39	7.2 ± 0.28	0.753

p value <0.05: Statistically significant; OSP: Oropharyngeal seal pressure; PIP: Peak inspiratory pressure; ETV: Mean exhaled tidal volume; N: Neutral; N-F: Neutral-flexion; N-E: Neutral-extension; N-RL: Neutral right lateral; N-LL: Neutral-left lateral.

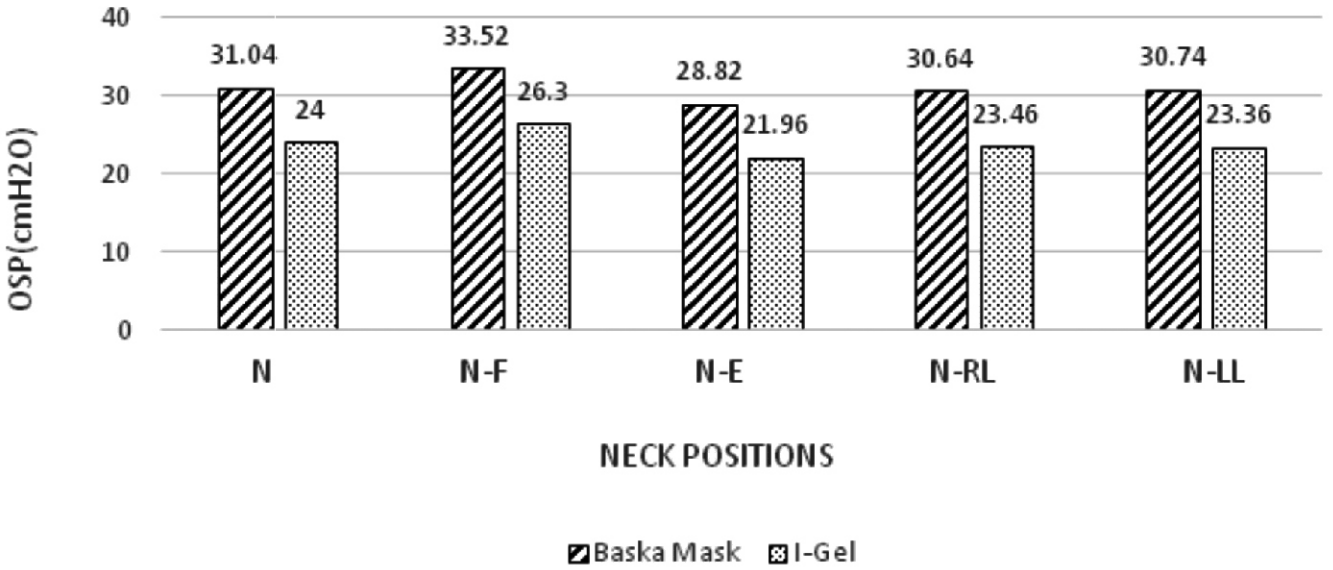

Figure 2: Difference in mean oropharyngeal seal pressure.

most of the cases (46, 92%) had one attempt for insertion and the rest four (8%) cases had two attempts for insertion.

Mean oropharyngeal seal pressure at different head and neck position among cases of Baska mask group was higher than cases of I-gel group and this difference in mean oropharyngeal seal pressure at different head and neck position was found to be statistically significant (p value <0.05) (Table 1 and figure 2).

Mean peak inspiratory pressure at different head and neck position among cases of Baska mask group was higher than cases of I-gel group except flexion position where peak inspiratory pressure was higher in cases of I- gel group and this difference in mean peak inspiratory pressure was found to be statistically significant at flexion (p value<0.05) and insignificant at neutral, extension, right lateral, and left lateral position (p value>0.05) (Table 1 and figure 3).

Mean exhaled tidal volume at neutral and flexion position was significantly higher among cases of Baska mask group compared to cases of I-gel group (p value <0.05) and difference at extension, right lateral, and left lateral position was found to be statistically insignificant (p value >0.05) (Table 1 and figure 4).

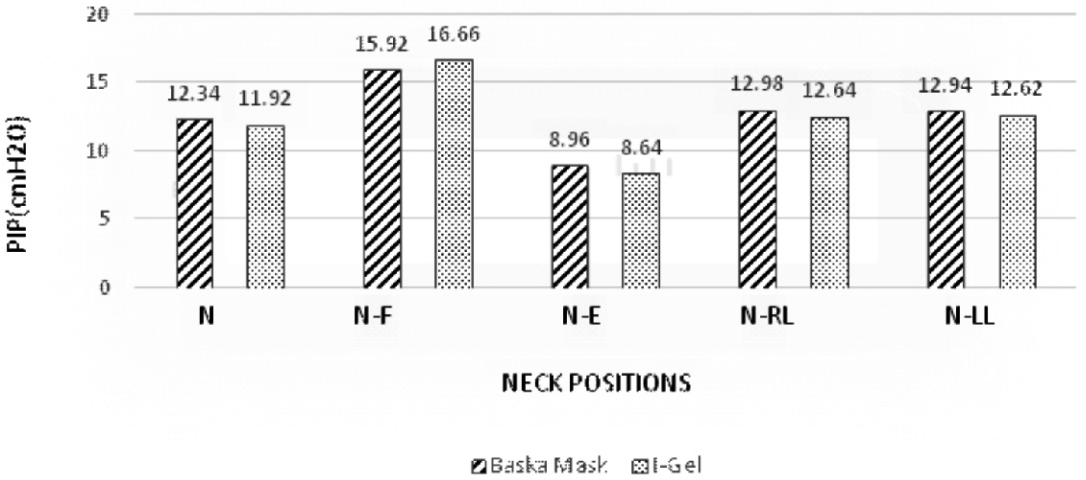

Figure 3: Difference in mean peak inspiratory pressure.

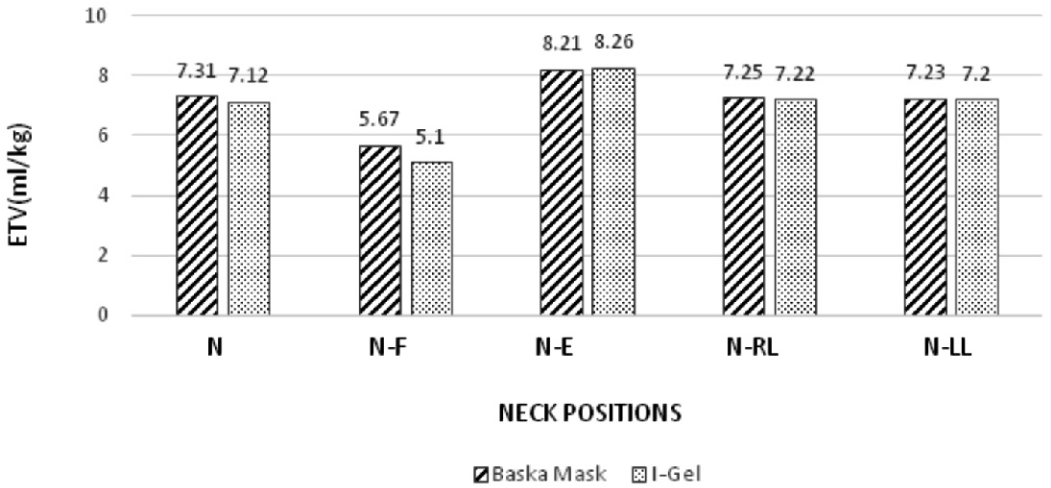

Figure 4: Mean difference in exhaled tidal volume.

Insertion time of device in the Baska mask group was 20.54±4.46 seconds and the insertion time of device in the I-gel group was 16.58±3.41 seconds. This difference is statistically significant (p value <0.05). Dysphonia was seen among 8% (4/50) cases of Baska mask group and 6% (3/50) cases of I-gel group. Sore throat was seen among 24% (12/50) cases of Baska mask group and 14% (7/50) cases of I-gel group. No dysphagia and laryngospasm were found in both the groups (Table 2).

DISCUSSION

The airway management is assessment, planning, and series of medical procedures required to maintain or restore an individual's ventilation or breathing. The supraglottic airway devices (SADs) are used to keep the upper airway open to provide unobstructed ventilation. An ideal SDA should be easy to insert and has less insertion time, good airway seal pressure, and minimum laryngopharyngeal morbidity. SADs rapidly replaced endotracheal intubation and face masks in >40% of general anesthesia cases due to their versatility and ease of use.

The present prospective randomized comparative study was undertaken to compare two supraglottic airway devices, namely, Baska mask and I-gel in anesthetized patients with respect to oropharyngeal seal pressure, peak inspiratory pressure, exhaled tidal volume in different head and neck positions, ease of insertion, time taken for insertion of device, number of attempts for successful insertion, and side effects in terms of postoperative sore throat and postoperative dysphonia. In group A (Baska mask group), mean oropharyngeal seal pressure was higher in every neck position in comparison to group B (I- gel group). In both groups, maximum OSP was achieved in neck flexion position and minimum OSP was achieved in

Table 2: Comparison of side effects on both groups

Side effects		Group A Baska mask		Group B I-gel		p value
		n	percentage	n	percentage	
Sore throat	Absent	38	76%	43	86%	0.308
	Present	12	24%	7	14%	
Dysphonia	Absent	46	92%	47	94%	1
	Present	4	8%	3	6%	
Dysphagia	Absent	50	100%	50	100%	0
	Present	0	0	0	0	
Laryngospasm	Absent	50	100%	50	100%	0
	Present	0	0	0	0	

$p < 0.05$; significant

neck extension position but in all positions the OSP was higher in Baska mask group which was statistically significant. In the present study, Baska mask group resulted in an increase in mean OSP compared with I-gel from neutral to the flexed neck position which can be accredited to larger and more compliant Baska masks as compared to I-gel. Results were comparable with the study done by Sidhu et al.[13]

Peak inspiratory pressure was higher in cases of I-gel group and this difference in mean peak inspiratory pressure was found to be statistically significant at flexion and insignificant at normal, extension, right lateral position, and left lateral position. The percentage increase in PIP from neutral to flexion was significantly more with I-gel compared to Baska mask (39.76% v/s. 29.01%; $p < 0.001$). The percentage change in mean PIP from neutral to extension with Baska mask and I-gel was 27.39% and 29.51%, respectively. Similar results were found in a study done by Sidhu et al.[13] Mean exhaled tidal volume at neutral and flexion position was significantly higher among cases of Baska mask group compared to cases of I-gel group and difference at extension, right lateral, and left lateral position was found to be statistically insignificant. Similar results were found in the study by Sidhu et al[13], there was significantly greater percentage decrease in ETV with I-gel compared to Baska mask during flexion. Agarwal et al[14] compared Baska mask with I-gel as ventilatory device in adult patients undergoing laparoscopic cholecystectomy and found that the mean oropharyngeal seal pressure (OSP) in group B after device insertion was 31.70 ±3.67 cm H_2O which was significantly higher than OSP in group I (27.30±2.93 cm H_2O). OSP after deflation of carboperitoneum was significantly higher in group B than in group I (31.33±3.51 cm H_2O v/s 28.20 ± 3.07 cm H_2O, respectively). In the present study also the mean OSP was higher with Baska mask as compared to I-gel. Dhanasekaran et al[15] in their study compared Baska mask, Proseal LMA, and I-gel during positive pressure ventilation in laparoscopic cholecystectomy. They compared OLP at insertion and 30 minutes of insertion and found that Baska mask provided higher sealing pressure as compared to other devices. The oropharyngeal leak pressure at insertion and at 30 minutes was higher in Baska mask group as compared to I-gel and Proseal group.

CONCLUSION

Baska mask and I-gel have comparable insertion success rates, insertion time, number of attempts for insertion, ease of insertion, and stable haemodynamic parameters. Hence, both I-gel and Baska mask can be used as ventilatory devices in anesthetized and paralyzed patients. However, Baska mask provides higher OSP than I-gel after device insertion and an added advantage of lower PIP and higher ETV than I-gel in maximum flexion position of the neck.

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