Doi: 10.5152/TJAR.2020.29569

Original Article

General Anaesthesia

Turkish Journal of Anaesthesiology & Reanimation

Comparison of Proseal Laryngeal Mask Airway with the I-Gel Supraglottic Airway During the Bailey Manoeuvre in Adult Patients Undergoing Elective Surgery

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Cite this article as: Kalra N, Gupta A, Sood R, Kaur M. Comparison of Proseal Laryngeal Mask Airway with the I-Gel Supraglottic Airway During the Bailey Manoeuvre in Adult Patients Undergoing Elective Surgery. Turk J Anaesthesiol Reanim 2021; 49(2): 107-13.

Abstract

Objective: Since the inception of Bailey manoeuvre, various authors have advocated for the substitution of endotracheal tube (ETT) with a supraglottic airway device (SAD) before the emergence from anaesthesia. There is scant information about the ideal supraglottic device in the literature. The present study compared the Proseal laryngeal mask airway (LMA) with the I-gel SAD during the Bailey manoeuvre. The primary objective was to compare these for ease of insertion and adequate placement of supraglottic airway, whereas the secondary objective was comparison of haemodynamics following the Bailey manoeuvre.

Methods: A total of 100 patients aged 18–60 years who were scheduled for elective surgery under general anaesthesia were randomised into 2 groups: group I (Bailey manoeuvre using Proseal LMA) and group II (Bailey manoeuvre using I-gel). The Bailey manoeuvre was performed 15 min before the end of surgery using the chosen supraglottic airway as per randomisation. We measured the ease of insertion (number of attempts required for insertion) and adequate placement (Brimacombe scoring) of SADs (fibre-optic bronchoscopy). Haemodynamic parameters were recorded until 10 min after the Bailey manoeuvre.

Results: The groups were comparable in terms of demographic parameters. Both the devices were comparable in terms of ease of insertion ($p>0.05$). Significantly higher ($p<0.05$) Brimacombe scores were seen with the I-gel. Significant ($p<0.05$) rise in systolic blood pressure, diastolic blood pressure, and mean arterial pressure was observed at the insertion of SAD, removal of ETT, and at 1 min after the Bailey manoeuvre in Proseal LMA in contrast to the I-gel.

Conclusion: This study showed that the I-gel provides a better glottic visualisation and haemodynamically superior profile compared with the Proseal LMA during the Bailey manoeuvre.

Keywords: Bailey manoeuvre, I-gel, Proseal LMA

Introduction

A smooth endotracheal tube (ETT) extubation without coughing, bucking, or haemodynamic changes is one of the most important anaesthetic goals during general anaesthesia. The adverse effects are more common during endotracheal extubation in contrast to the intubation. There are transient increases in the arterial blood pressure and heart rate (HR) in the range of 10% to 30% lasting from 5 to 15 min, which may lead to unfavourable sequelae, such as myocardial ischaemia, left ventricular failure, cerebrovascular accident, and detrimental increase in intracranial or intraocular pressures (1-3). There are various pharmacological and non-pharmacological techniques that have been employed to attenuate the stress response at extubation (4, 5).

Supraglottic airway devices (SADs) have gained immense popularity not only for their use in airway management but also for causing fewer cardiovascular responses at removal than the extubation of tracheal tube (6, 7). The inser-

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Received: 14.04.2019 Accepted: 26.11.2019
Available Online Date: 30.11.2020

tion of SADs cause lesser laryngeal trauma and may provoke less sympathetic stimulation (8, 9).

Since the inception of the Bailey manoeuvre (10, 11), various authors have advocated for the substitution of ETT with SADs before the emergence from anaesthesia. This procedure has been found to be associated with a lesser haemodynamic stress response during extubation as well as a smooth recovery period (12-16).

Various supraglottic devices such as the Classic laryngeal mask airway (LMA) and the Ambu laryngeal mask have been referred to in the literature with respect to their use during the Bailey manoeuvre (16). Although I-gel supraglottic airway has been used widely to decrease the sympathetic response during extubation (17), there is paucity of information in the literature about its use during the Bailey manoeuvre. In this study, we compared the Proseal LMA with the I-gel supraglottic airway for the ease of insertion, adequate placement, and haemodynamic responses during the Bailey manoeuvre. Our primary objective was comparison for the ease of insertion (number of attempts required for insertion) and adequate placement (Brimacombe scoring) of SADs using fibre-optic bronchoscopy, whereas the secondary objective was to compare haemodynamic parameters until 10 min after the Bailey manoeuvre.

Methods

Study design and participants

Based on the available previous literature (16), the study's sample size was a total of 100 cases. With an α of 0.05, power of study of 80%, and a confidence level of 95%, a minimum number of 50 subjects under each group satisfying the inclusion and exclusion criteria were selected. After approval from the Hospital Ethics Committee, 100 American Society of Anesthesiologists (ASA) grade I and II patients between the age range of 18–60 years, undergoing elective surgery, and who gave written informed consent for participating in this study were selected. Patients with predicted difficult intubation, high risk of aspiration, and who had undergone surgery involving oral or nasal cavity were excluded from the study. The patients were randomly divided into 2 groups of 50 each, using randomised computer tables. The 2 groups were as follows:

- Group PLMA: Proseal LMA was used for the Bailey manoeuvre.
- Group I-Gel: I-gel supraglottic airway was used for the Bailey manoeuvre.

Study protocol

All patients were kept nil per oral overnight and received alprazolam 0.25 mg and ranitidine 150 mg orally, the night before surgery and in the morning of surgery. In the operation theatre, HR, systolic blood pressure (SBP), diastolic blood pressure (DBP), mean arterial pressure (MAP), electrocardiogram (ECG), oxygen saturation (SPO_2), and Bispectral Index (BIS) monitoring was performed, and baseline values were recorded. The anaesthetic induction was performed as per institutional protocol, and endotracheal intubation was performed with cuffed ETT of appropriate size. Intra-operatively, neuromuscular blockade and analgesia was achieved with intermittent boluses of inj. vecuronium 0.02 $mg.kg^{-1}$ intravenous and injection fentanyl 0.05$ug.kg^{-1}$ intravenous, respectively. Sevoflurane was used to maintain a minimum alveolar concentration (MAC) of 1 and a BIS value of 45–60. Mechanical ventilation was done using oxygen and nitrous oxide in ratio of 33:67 with a total flow of 3 L min^{-1}. The ventilation was adjusted to maintain an end-tidal carbon dioxide at 35–40 mm Hg.

About 15 min before the end of surgery, patient was ventilated with 100% oxygen and sevoflurane concentration adjusted to maintain a MAC at 1 and BIS value between 45 and 60. HR, SBP, DBP, MAP, SPO_2, ECG, and BIS values were recorded.

Based on the group chosen, an appropriate-sized SAD as per the body weight was inserted, after performing gentle oropharyngeal suction (Figure 1).

Figure 1. SAD inserted behind ETT after performing gentle laryngoscopy and oropharyngeal suction
ETT: endotracheal tube; SAD: supraglottic airway device

Main Points:

- Bailey manoeuver (ETT/LMA exchange technique) helps in attenuation of haemodynamic stress response at extubation.
- Igel supraglottic airway provides significantly better ease of insertion and supraglottic views as compared to the Proseal LMA.
- Igel Supraglottic airway device provides superior hemodynamic profile during Bailey manoeuver as compared to the Proseal LMA.

Figure 2. ETT removed after deflating the cuff
ETT: endotracheal tube

Figure 3. Left: FOB inserted via the airway tube of the SAD; Right: A Brimacombe score of 3 (vocal cords plus posterior epiglottis visible) is observed with the I-gel airway
FOB: fibre-optic bronchoscope

- G_{PLMA}: Deflated Proseal LMA inserted behind the ETT and inflated with air as per the recommended volume.
- **$G_{I\text{-}Gel}$**: I-gel supraglottic airway inserted behind the ETT.

The ease of insertion and number of attempts during Proseal LMA and I-gel supraglottic airway insertion were noted. The ease of insertion was graded as Easy, if SAD placement was successful in the first attempt without resistance, and Difficult, if more than 1 attempt was required to place it, or resistance was encountered while placing the device (18).

Lubricated gastric tube was inserted through the gastric channel so as to ensure correct placement of SAD and also prevent aspiration. Tracheal tube cuff was deflated, and ETT was removed while maintaining positive pressure (Figure 2). After confirmation of adequate placement of SAD clinically with adequate chest rise and via capnography, the ventilation was continued. HR, SBP, DBP, MAP, ECG, SPO_2, and BIS values were recorded immediately after SAD insertion; after the removal of ETT and at 1, 2, 3, 5, and 10 min afterward. A fibre-optic bronchoscope was inserted via the airway tube of Proseal LMA/I-gel supraglottic airway to grade the adequate placement of the device using Brimacombe (19) score (Figure 3).

The Brimacombe score was classified as follows: 4=only vocal cords visible, 3=vocal cords plus posterior epiglottis visible, 2=vocal cords plus anterior epiglottis visible, and 1=vocal cords not seen.

All the procedures performed during the study were carried out by a single skilled anaesthesiologist.

Table 1. Demography and patient characteristics

Age and weight distribution	Group I (n=50) Mean±SD	Group II (n=50) Mean±SD	p
Age (y)	34.28±11.45	37.82±13.19	0.155[a]
Weight (kg)	58.64±6.11	56.42±7.97	0.121[b]
Sex (male/female)	21/29	30/20	0.072[c]

[a,b]Unpaired t-test. cChi-square test. SD: standard deviation.

Table 2. Comparison for ease of insertion

Ease of insertion	Group I (n=50)		Group II (n=50)		p
	Frequency	%	Frequency	%	
Difficult	11	22.0	9	18.0	0.617[a]
Easy	39	78.0	41	82.0	
Total	50	100	50	100	

[a]Chi-square test.

Table 3. Comparison for adequate placement of SAD

Adequate placement (Brimacombe scores)	Group I (n=50)		Group II (n=50)		p
	Frequency	%	Frequency	%	
I	6	12.0	1	2.0	<0.001[a]
II	11	22.0	3	6.0	
III	12	24.0	6	12.0	
IV	21	42.0	40	80.0	
Total	50	100	50	100	

[a]Unpaired t-test. SAD: supraglottic airway device.

Table 4. Changes in heart rate during periextubation period

HR	Group I (n=50), HR/min Mean±SD	Group II (n=50), HR/min Mean±SD
Baseline before induction	75.5±5.14	76.32±5.1
Before Bailey manoeuvre	74.96±5.22	75.72±6.13
After supraglottic insertion	76.54±5.39[a]	76.98±5.02
Immediate post extubation	78.38±5.63[a]	77.1±5.97
1 min post extubation	76.96±6.17[a]	77.04±4.98
2 min post extubation	75.7±5.89	77.1±4.96
3 min post extubation	76.3±5.09	75.8±4.6
5 min post extubation	75.1±4.54	75.72±5.11
10 min post extubation	74.76±4.64	75.8±5.9

[a]p<0.05 as compared with the baseline value. HR: heart rate; SD: standard deviation.

Statistical analysis

Quantitative variables were compared using unpaired *t*-test between the 2 groups and paired *t*-test within the group. Qualitative variables were compared using the chi-square test. A p value of <0.05 was considered statistically significant. The data were entered in Microsoft Excel spreadsheet, and analysis was performed using the IBM Statistical Package for Social Sciences (IBM SPSS Corp.; Armonk, NY, USA) version 21.0.

Results

Both the groups were comparable in terms of their demographic characteristics (age, weight, and gender) (Table 1).

The ease of insertion (Table 2) was more with the I-gel (41/50 patients required single attempt with no resistance at insertion) than with the Proseal LMA (39/50 patients required single attempt with no resistance at insertion), which was statistically comparable.

The I-gel provided a better view of the glottis (Table 3) than the Proseal LMA (92% in group II and 66% in group I had Brimacombe scores of III or IV), which was statistically significant (p<0.05).

We observed a significant (p<0.05) rise in HR, SBP, DBP, and MAP (Tables 4, 5, 6, and 7) above the baseline values in group $_{PLMA}$, which started immediately after insertion of the SAD, maximum being immediately after removal of the ETT and continued until 1 min after the Bailey manoeuvre. Thereafter, there was a fall towards the baseline values by 5–10 min following the manoeuvre. A similar trend was observed in group $_{I\text{-}Gel}$; however, the rise in the haemodynamic parameters was statistically insignificant (p>0.05) at all the measured intervals in group $_{I\text{-}Gel}$. BIS was comparable (p>0.05) in both

Table 5. Changes in systolic blood pressure during periextubation period

Systolic blood pressure	Group I (n=50), mm Hg Mean±SD	Group II (n=50), mm Hg Mean±SD
Baseline	129.18±5.17	129.92±5.55
Before Bailey manoeuvre	128.9±5.27	128.82±6.13
After supraglottic insertion	132.66±5.17[a]	130±6.98
Immediate post extubation	139.74±4.75[a]	130.4±5.87
1 min post extubation	133.76±3.24[a]	130.1±5.35
2 min post extubation	129.7±5.31	129.8±5.28
3 min post extubation	130.4±5.35	129.44±5.27
5 min post extubation	129.64±5.19	129.2±4.96
10 min post extubation	129.1±3.57	129.56±5.26

[a]p<0.05 as compared with the baseline value. SD: standard deviation.

the groups. There was no significant change in the BIS value during the Bailey manoeuvre from before the Bailey manoeuvre in both the groups (Table 8).

Discussion

Haemodynamic disturbances and respiratory complications are some of the chief concerns during ETT extubation. Extubation of trachea is traditionally performed when the patient is either fully "awake" or "deeply anaesthetised". Awake extubation is generally considered safer as the return of airway tone, reflexes, and respiratory drive allows the patient to maintain their own airway (20). But it may be associated with significant haemodynamic stimulation, which may lead to bleeding from the surgical wound site and an increase in intracranial and intraocular pressures (21, 22).

Table 6. Changes in diastolic blood pressure during periextubation period

Diastolic blood pressure	Group I (n=50), mm Hg Mean±SD	Group II (n=50), mm Hg Mean±SD
Baseline	75.7±4.08	77.22±3.81
Before Bailey manoeuvre	75.08±5.08	76.42±5.9
After supraglottic insertion	79.92±4.59 *	77.5±4.59
Immediate post extubation	81.22±4.02 *	77.8±4.58
1 min post extubation	78.52±3.86 *	77.3±4.51
2 min post extubation	76.08±3.66	76.9±4.84
3 min post extubation	75.4±4.07	76.5±4.55
5 min post extubation	75.1±4.97	76.38±4.52
10 min post extubation	74.9±4.35	76.48±4.22

*p<0.05 as compared with the baseline value. SD: standard deviation.

Table 7. Changes in mean blood pressure during periextubation period

Mean blood pressure	Group I (n=50), mm Hg Mean±SD	Group II (n=50), mm Hg Mean±SD
Baseline	93.53±4.04	94.79±3.82
Before Bailey manoeuvre	93.02±4.53	93.89±4.98
After supraglottic insertion	97.5±4.13[a]	95±4.61
Immediate post extubation	100.73±3.68[a]	95.33±4.1
1 min post extubation	96.93±2.98[a]	94.9±4.03
2 min post extubation	93.95±3.54	94.53±4.02
3 min post extubation	93.73±3.91	94.15±3.99
5 min post extubation	93.28±4.27	93.99±3.8
10 min post extubation	92.97±3.19	94.17±3.81

[a]p<0.05 as compared with the baseline value. SD: standard deviation.

Extubation of trachea in deep anaesthesia is a common method to avoid this stress response. This can be achieved by the use of inhalational agents or opioids, but they may cause loss of the airway with aspiration risk and prolonged sedation (23).

Pharmacological agents such as lidocaine, beta blockers, calcium channel blockers, and dexmedetomidine are also partially effective in controlling the haemodynamic response during extubation (5, 24).

One of the non-pharmacological technique to attenuate the stress response at extubation is the Bailey manoeuvre (ETT/LMA exchange technique) described in 1995 by Dr. P.M. Bailey (10). This method involves placing the LMA before the removal of ETT while patient is in a deep plane of anaesthesia, enough for the patient to tolerate smooth LMA insertion and endotracheal extubation. The advantage of in situ ETT during LMA insertion is that it splints the epiglottis, and the LMA easily slides behind it without the problem of occlusion of airway by epiglottis. This technique also ensures that there is no risk of losing the airway, during difficult or failed LMA insertion (20).

Various SADs such as the Classic LMA (10-14), Proseal LMA (25, 26), and Ambu laryngeal mask (16) airway have been used for the Bailey manoeuvre, but the literature is limited in comparison of SADs for the Bailey manoeuvre.

We found that the ease of insertion was more with the I-gel supraglottic airway compared with Proseal LMA, though statistically insignificant. In a study done by Singh et al. (18) in 2009, it was observed that the I-gel supraglottic airway had a significantly higher ease of insertion than the Proseal LMA. Insertion of an LMA with a bulky inflatable cuff, like the Pro-

Table 8. Changes in BIS during periextubation period

BIS	Group I (n=50), mm Hg Mean±SD	Group II (n=50), mm Hg Mean±SD
Baseline	97.02±2.12	96.88±2.27
Before Bailey manoeuvre	50.56±2.76	50.62±2.69
After supraglottic insertion	52.44±2.39	52.42±2.56
Immediate post extubation	55.12±1.97	55.16±2.00
1 min post extubation	62.24±2.31	62.46±2.38
2 min post extubation	66.84±2.04	66.74±2.36
3 min post extubation	73.40±2.32	73.86±2.47
5 min post extubation	80.78±3.54	80.10±3.14
10 min post extubation	87.72±2.35	87.82±2.41

BIS scores comparable between the two groups at all measured intervals (p>0.05) seal LMA, may lead to a difficult intraoral positioning and manipulation. In addition, the deflated leading edge of the Proseal LMA can catch the edge of the epiglottis and may cause its down folding, leading to improper positioning of the LMA beneath the tongue (27, 28). However, in our study, the ease of insertion was comparable during the Bailey manoeuvre. This may be because of the fact that during the Bailey manoeuvre, the distal part of the laryngeal mask is inserted into the hypopharynx, not the larynx; hence, the presence of a tracheal tube should not prevent correct positioning of the laryngeal mask but would rather facilitate an easier insertion of the supraglottic device (15).

The fibre-optic imaging scores (Brimacombe) (19) in our study were significantly superior with I-gel supraglottic airway than with the Proseal LMA. Chauhan et al. (29) in their study compared the insertion characteristics of the I-gel supraglottic airway with those of the Proseal LMA where fibre-optic scoring revealed that the I-gel achieves an excellent anatomic fit significantly superior to the Proseal LMA. It has been shown through a cadaveric study that the tensile properties of the I-gel supraglottic airway bowl, along with its shape and the ridge at its proximal end, contribute to the stability of the device upon insertion (30).

Our study demonstrated a significantly superior haemodynamic profile and less pressor response with the I-gel supraglottic airway as compared with the Proseal LMA following the insertion of the SAD.

Placement of any SAD is expected to be associated with haemodynamic changes, which can be attributed to the stimulation of afferent receptors on the wall of the pharynx, which carry the impulses to the vasomotor centre, thereby resulting in a reflex sympathetic response. The enhanced response in the Proseal LMA group may be due to the pressure of the cuff of the airway device on the walls of the pharynx during inflation, which when compared with the I-gel supraglottic airway would not be expected to occur, with the latter being a non-inflatable cuffed device (30).

Furthermore, Proseal LMA being a variant of the Classic LMA with a double cuffed mask is inserted using a metal introducer, which reaches the base of the tongue, thereby causing irritation. This may contribute to a vasopressor response (31).

There were certain limitations of our study. The effects were studied in ASA I/II patients; however, ETT/SAD exchange can be further studied in ASA III/IV cardiac or neurosurgical patients, in whom good haemodynamic control is required. We did not measure the duration of insertion and cuff pressure in our study, which may have a bearing on post-operative sore throat. Moreover, we did not evaluate the incidence of sore throat and trauma to the airway following the Bailey manoeuvre, which can further have an impact on the use of these devices for this manoeuvre.

Conclusion

We conclude that the I-gel supraglottic airway provides a significantly superior profile in terms of ease of insertion, adequacy of placement, and haemodynamics and can be used as a safe and suitable alternative to the Proseal LMA during the Bailey manoeuvre.

Ethics Committee Approval: Ethics committee approval was received for this study from the ethics committee of Institutional Ethics Committee, Dr. Ram Manohar Lohia Hospital (Approval No.- 1-40/3/2014/IEC/Thesis/PGIMER-RMLH/-1444).

Informed Consent: Written informed consent was obtained from patients who participated in this study.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – N.K., A.G., R.S., M.K.; Design – N.K., A.G., R.S., M.K.; Supervision – N.K., A.G., R.S., M.K.; Resources – N.K., A.G., R.S., M.K.; Materials - – N.K., A.G., R.S., M.K.; Data Collection and/or Processing – N.K., A.G., R.S., M.K.; Analysis and/or Interpretation – N.K., A.G., R.S., M.K.; Literature Search – N.K., A.G., R.S., M.K.; Writing Manuscript – N.K., A.G., R.S., M.K.; Critical Review – N.K., A.G., R.S., M.K.

Conflict of Interest: The authors have no conflicts of interest to declare.

Financial Disclosure: The authors declared that this study has received no financial support.

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