
Research Article**Evaluation of Gum Elastic Bougie Guided Proseal Laryngeal Mask Airway Insertion Technique****Dr. VenkateshSubramanyam***

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Abstract: *Introduction:* Endotracheal Intubation (ETI) is gold standard for airway management. Proseal Laryngeal Mask Airway (PLMA) insertion using Gum Elastic Bougie (GEB) guidance, which has got 100% first attempt success rate, also requires laryngoscopy, hence nullifying its advantage of being a supraglottic airway device. We aimed to compare the haemodynamic responses associated with laryngoscopy assisted GEB guided PLMA placement with that of conventional endotracheal intubation. *Method:* Hundred normotensive ASA1 or 2 patients of either sex (age 18 to 40yrs) undergoing general anesthesia for elective surgery included and evaluated for pressor response. Following a uniform premedication and standard anesthesia technique (thiopentone + vecuronium), either of airway was placed and Heart rate, HR (beats/min); Mean blood pressure, MAP (mmHg) (at Tb =base line, T0=just before laryngoscopy and PLMA/ETT placement, T1 =1min, T3= 3min, T5 =5 min, T7 =7 min after placement). *Results:* Patients demographics between the PLMA and ETT groups were similar. Following laryngoscopy and PLMA/ETT placement, both were associated with statistically significant increase in HR and MAP with respect to its basal value. Although it was less marked in case of PLMA group, when comparison was made within individual group. Duration of laryngoscopy and time of placement were longer in PLMA group as compared to ETT group (35.71 and 12.69 sec. vs 21.30 and 10.76 sec. respectively). ETT insertion was associated with higher incidence of cough ($p<0.05$), but similar for sore throat and hoarseness ($p>0.05$). *Conclusion:* Hence GEB guided PLMA technique should only be used as a backup technique for when standard insertion techniques fail and in failed tracheal intubation where the bougie is accidentally inserted into oesophagus and rapid control of the airway is required. However, since this technique of insertion is associated with significant pressor response, it should not be used in patients with hypertension, ischemic heart disease or poor left ventricular function.

Keywords: Gum Elastic Bougie, Proseal Laryngeal Mask Airway, Insertion Technique.

INTRODUCTION

The laryngeal mask airway (LMA) is a supraglottic airway device, introduced by Dr. Archie Brain in 1983. It fills the gap in airway management between tracheal intubation and use of the face mask. The major advantage of LMA over endotracheal tube (ETT) is that it avoids the use of laryngoscope to visualise and penetrate the laryngeal opening and hence produces less hemodynamic changes [1, 2].

In the year 2000 a new version of "LMA Proseal" which incorporates another tube to allow second seal against upper oesophageal sphincter giving continuity with the alimentary tract and isolating it from the airway [3]. PLMA as a replacement device for LMA as it can achieve a more effective seal and facilitates gastric tube placement without an increase in directly measured mucosal pressure [4, 5].

Proseal laryngeal mask airway is designed to be inserted using either index finger or a special

introducer tool (IT) as described by the manufacturer. [6] However, another new method of insertion has recently been described which involves the use of gum elastic bogie (GEB). The drain tube of proseal LMA is primed with bougie whose distal end is placed in the oesophagus under laryngoscopic guidance. Then the proseal LMA is inserted digitally along palatopharyngeal curve and bougie removed [7, 8]. The authors claimed that GEB guided insertion of PLMA has a higher first attempt success rate as compared to other methods (GEB, 100%; digital 88%; IT 84%) [9] and is associated with minimal hemodynamic changes and a low incidence of trauma [7]. The main cause of insertion difficulty with older techniques is impaction of PLMA cuff at the back of the mouth and failure of the distal cuff to reach the hypopharynx which is overcome by GEB guided technique [9].

Laryngoscopy has been implicated as the main culprit for increase in pressor response due to stimulation of base of the tongue induced by the tip of

its blade lifting the epiglottis. [10]. The most important factor influencing the cardiovascular response is duration for laryngoscopy and forces applied during it [11, 12].

Hence this seems likely that laryngoscopic assisted proseal LMA placement with GEB guided technique might also have increased pressor response thus nullifying its advantage of being a supraglottic device. Keeping this in mind, it was proposed to study the difference in pressor responses with this technique of insertion of proseal LMA as against conventional placement of ETT which also requires laryngoscopy.

MATERIAL AND METHODS

One hundred normotensive patients of either sex belonging to ASA I or II, between 20-40 years of age, scheduled to undergo elective surgery, requiring general anaesthesia were included.

Exclusion criteria: Patient with a known or predicted difficult airway, Mouth opening <2.5cm, Body mass index >35kgm⁻², any patient with a history of regurgitation, Known case of hypertension and ischemic heart disease.

In this prospective randomized trial, all the patients were examined during the preoperative visit a day prior to surgery. Details regarding the patient’s clinical history, physical examination, Mallampati score, mouth opening, and basic routine investigations were recorded. Informed consent was taken for patient’s participation in the study. Every patient was kept fasting for six hours prior to scheduled time of surgery and premedicated with tablet alprazolam 0.25mg and tablet ranitidine 150mg orally at bedtime and at two hours preoperatively. On arrival of the patient in the operating room, non-invasive monitoring of Blood pressure (NIBP), ECG and pulse oximetry was established using Siemens SC 5000 monitor Basal recordings of systolic (SBP) and Diastolic Blood Pressure (DBP), Heart Rate (HR) and arterial saturation of oxygen (SPo₂) on air were noted. An intravenous (i.v.) line was started. Patients were then randomly allocated to either group-PLMA (n=50) or group-ETT (n=50).

Patient’s head was positioned on a pillow of 7cm height and neck flexed and head extended i.e. the standard sniffing position for intubation. After induction using sleep dose of thiopentone 4-6mgkg⁻¹ followed by 0.1mgkg⁻¹ vecuronium bromide patient were ventilated for 120 seconds via face mask using Bain’s breathing system.

For group-PLMA patients, a well lubricated PLMA loaded with GEB with fully deflated cuff, size 3

(for female) or size 4 (for male) was introduced using standard midline approach as described by the inventor of the device i.e., positioning the GEB 5-10cm into the esophagus under direct laryngoscopic guidance, advancing the PLMA against palatopharyngeal curve using digital guidance while the assistant hold the curved end of bougie, withdrawing the bougie while holding the PLMA in position. Then the cuff was inflated with sufficient air to keep cuff pressure around 60cm H₂O. The correct placement of PLMA was judged clinically by the ability to ventilate the patient without substantial leak at an airway pressure of <20cm of H₂O and by auscultation of breath sounds.

For group ETT patients, an appropriate size cuffed ETT (size 7.0mm, 7.5mm ID for female and size 8.0mm; 8.5mm ID for male) was inserted using standard technique for intubation.

Further anesthesia in patients of both the groups was maintained with 0.5% halothane and 67% nitrous oxide in O₂. Heart rate (HR), Blood Pressure (BP) and arterial pressure of oxygen saturation (SPo₂) was recorded at following time intervals.

- Tb Basal i.e. before start of induction of anesthesia
- T0 Just before PLMA or ETT insertion but after administration of thiopentone and vecuronium bromide
- T1 One minute after successful placement of PLMA/ETT
- T3 Three minute after successful placement of PLMA/ETT
- T5 Five minute after successful placement of PLMA/ETT
- T7 Seven minute after successful placement of PLMA/ETT

Number of attempts, duration of laryngoscopy and time required for the proper placement of PLMA/ETT was recorded. Time required for successful placement was measured from the start of laryngoscopy to the confirmation of proper placement. Surgery could commence after administering analgesia in form of either pethidine or morphine.

At the end of surgery, neuromuscular blockade was reversed with atropine 0.02mgkg⁻¹ and neostigmine 0.05mgkg⁻¹. Any post-operative complications like cough, sore throat, hoarseness of voice was noted.

STATISTICAL ANALYSIS

Parameters collected were compiled and analysed using paired and unpaired ‘t’ test, chi-square test and Fisher exact test.

Table-1: Age, weight, height and sex distribution in two groups (Mean±SD)

	Gp A (n=50)	Gp B (n=50)	p value
Age (years) Mean±SD	33.80±9.16	31.82±7.39	>0.05

Weight (Kg) Mean±SD	57.78±9.6	57.52±11.76	>0.05
Height(cm) Mean±SD	160.62±5.88	160.66±5.94	>0.05
Sex (male/female) (n)	22/28	20/30	>0.05

Age, weight, height and sex distribution in the two groups is represented.

Table-2: Duration of laryngoscopy in two groups (Mean±SD)

Group	Duration of Laryngoscopy (sec.)	p value
PLMA	12.69±2.33	<0.001**
ETT	10.76±1.35	

** $p < 0.001$ (highly significant)

In table 2, the difference in the duration of laryngoscopy is statistically highly significant ($p < 0.001$) between group A and B.

Table-3: Time of PLMA/ETT placement in two groups (Mean±SD)

Group	Time of Placement (sec.)	p value
A	35.71±4.80	<0.001**
B	21.30±3.18	

** $p < 0.001$ (highly significant)

Time taken for placement of PLMA/ETT is shown in table 3. It shows statistically highly significant difference ($p < 0.001$) between group A and B.

Table-4: Heart rate in two groups at different time intervals (Mean±SD)

Group	T _B	T ₀	T ₁	T ₃	T ₅	T ₇
A	81.96±12.21	87.92±13.93	96.30±16.02	92.08±19.93	84.46±13.88	80.14±13.19
B	85.26±16.05	90.62±10.58	104.34±13.10	97.44±11.39	90.80±11.60	84.22±9.36
p value	>0.05	>0.05	<0.05*	>0.05	>0.05	>0.05

* $p < 0.05$ (significant)

T_B = Basal value

T₀ = Just after induction, but before laryngoscopy and PLMA/ETT placement

T₁ = 1 minute after PLMA/ETT placement

T₃ = 3 minute after PLMA/ETT placement

T₅ = 5 minute after PLMA/ETT placement

T₇ = 7 minute after PLMA/ETT placement

In tables 4, mean heart rate in both the groups at all specified time interval was comparable except at 1min. after airway insertion when rise in heart rate in group B was significant more than group A.

Table-5: Systolic blood pressure in two groups at different time intervals (Mean±SD)

Group	T _B	T ₀	T ₁	T ₃	T ₅	T ₇
A	122.96±12.97	108.64±10.41	135.52±16.30	123.74±13.09	122.26±45.20	113.80±10.12
B	124.22±11.72	104.54±11.56	146.96±14.36	131.54±13.99	120.42±12.51	116.16±12.41
p value	>0.05	>0.05	<0.001**	<0.001**	>0.05	>0.05

** $p < 0.001$ (highly significant)

The baseline (T_B) systolic blood pressure as well as blood pressure just before airway placement but after induction i.e (T₀) were statistically comparable in two groups ($p > 0.05$). One minute after ETT/PLMA placement (T₁) rise in systolic blood pressure was greater in group B as compared to group A. When analysed statistically the difference was found to be significant ($p < 0.001$). The difference in rise in systolic blood pressure in both the groups remained statistically significant till T₃, after which it returned to near base line values (T₅) or even low (T₇) (table 5).

Table-6: Diastolic blood pressure in two groups at different time intervals (Mean±SD)

Group	T _B	T ₀	T ₁	T ₃	T ₅	T ₇
A	78.32±8.13	70.34±3.45	89.96±14.13	80.40±10.25	75.56±8.86	74.58±8.13
B	79.62±7.81	67.98±7.91	97.56±12.96	87.12±7.62	79.20±8.39	76.48±9.16
P value	>0.05	>0.05	<0.001**	<0.001**	<0.05*	>0.05

* $p < 0.05$ (significant) ** $p < 0.001$ (highly significant)

In table 6, the diastolic blood pressure baseline as well as just before airway placement (T_B) and following induction just before laryngoscopy and airway placement (T_0) were statistically comparable in two groups ($p > 0.05$). Following airway placement at T_1 there was significant greater rise in diastolic blood pressure in group B as compared to group A ($p < 0.001$). The difference in both the groups remains statistically significant till T_5 which ultimately touched base lie at around 7 minutes after airway placement (T_7) (i.e. 7 min after airway placement) ($p > 0.05$).

Table-7: Mean arterial pressure changes in two groups at different time intervals (Mean±SD)

Group	T_B	T_0	T_1	T_3	T_5	T_7
A	93.20±9.04	83.10±7.65	105.14±14.45	94.84±10.62	91.13±18.38	87.65±8.17
B	94.48±8.48	80.16±8.4	114.03±12.59	101.92±8.86	92.94±9.05	89.70±9.42
p value	>0.05	>0.05	<0.05*	<0.05*	>0.05	>0.05

* $p < 0.05$ (significant)

In table 7, the mean arterial pressure at baseline (T_B) as well as just before airway placement (T_0) were statistically comparable in two groups ($p > 0.05$). One and three minutes after airway placement (T_1 , T_3) mean arterial pressure registered a significant rise in mean arterial pressure which was more marked in group B. As 5 minutes and 7 minutes after airway placement (T_5 & T_7) mean arterial pressure in both groups returned to near baseline reading which was statistically insignificant when compared between two groups ($p > 0.05$).

DISCUSSION

One hundred patients aged between 20-40 years having physical status grade I and II according to American Society of Anaesthesiologist (ASA) scheduled to undergo elective surgery under general anaesthesia were randomly allocated to one of the two groups. In group A patients, Proseal LMA was used as an airway device which was introduced using gum elastic bougie technique following laryngoscopy [7]. In group B patients, endotracheal tube was introduced using conventional technique. Pressor responses in the form of increase in heart rate, systolic, diastolic and mean arterial pressure were recorded and compared using chi-square, paired and unpaired 't' tests.

Pressor response is a common occurrence following laryngoscopy and tracheal intubation. When laryngoscopy or intubation is carried out, there is mechanical irritation of stretch receptors situated in respiratory tract. This leads to reflex sympathoadrenal response in the form of increase in catecholamine concentration which results in pressor responses [13].

Shribman *et al.* suggested that major cause of sympathoadrenal response to tracheal intubation is the stimulation of upper airways by tissue tension induced by laryngoscope. He added that the introduction of tracheal tube through the vocal cords and inflating a cuff in the infraglottic region contribute very little additional stimulation [14].

To avoid pressor response to laryngoscopy, supraglottic devices have been introduced in

anaesthesia practice which does not require laryngoscopy for their placement. One such device is Proseal laryngeal mask airway, which has been used in this study.

Conventionally Proseal LMA is placed using either index finger or introducer tool technique. However, Hawathet *et al.*, reported that the gum elastic bougie aided placement of Proseal LMA under laryngoscopic guidance, is better than index finger or introducer tool technique. They suggested that gum elastic bougie guides the tip of PLMA towards the hypopharynx and prevents its impaction at the back of mouth [15].

Since this technique requires laryngoscopy, it is likely to evoke pressor response because of stretching and stimulation of base of the tongue. Surprisingly, a study conducted by Howathet *et al.* to evaluate this new technique revealed that laryngoscopy followed by gum elastic bougie primed proseal LMA placement is associated with no change in heart rate or blood pressure [7].

In our study however, laryngoscopic assisted GEB guided placement of proseal LMA was associated with significant increase in mean arterial pressure and heart rate. This difference could be because of difference in the method of induction in the two studies. While we used sleep dose of thiopentone and vecuronium bromide for induction of anaesthesia in our patients, Howathet *et al.* used midazolam, fentanyl and propofol. Midazolam and fentanyl used in their study are known to modulate the pressor response of laryngoscopy. Also use of propofol for induction of anaesthesia is known to achieve greater fall in blood pressure in comparison with the use of thiopentone alone. Moreover, they also used lack of response to jaw thrust as an end point of induction, unlike our study where we used loss of eye lash reflex for the same. It is a known fact that lack of response to jaw thrust requires deeper planes of anaesthesia as compared to loss of eyelash reflex which might explain milder pressor response in their study. This interpretation is in accordance with the study conducted by Yakaitset *et al.*

which concluded that greater depth of anaesthesia abolishes the tracheal and carinal reflexes which are responsible for pressor response [16].

In our study, the duration of laryngoscopy and time of placement of PLMA/ETT were significantly higher in PLMA group as compared to ETT group (12.69 & 35.71 sec. vs 10.76 & 21.30 sec.) respectively. It is well known that hemodynamic response to laryngoscopy are proportional to the duration of laryngoscopy [17]. In our study, although we did not measure the forces applied during laryngoscopy in two groups, but forces required for laryngoscopy for GEB guided placement of PLMA (group A) is considered to be less than laryngoscopy for intubation (group B) as less force is required to see the posterior part of glottis than the anterior.

In our study basal values of blood pressure and heart rate were comparable in both the groups. Following laryngoscopy and PLMA/ETT placement BP and HR increased significantly in both the groups. The rise in BP and HR following PLMA placement was significantly less marked than tracheal intubation ($p < 0.05$). Hence, it is evident from the above observations that, although duration of laryngoscopy was more in PLMA group, pressor response was more in ETT group.

So, it can be inferred from our study that although laryngoscopic assisted, GEB guided proseal LMA placement is associated with significant pressor response, but this pressor response is more in cases of laryngoscopy and intubation. This interpretation is in accordance with the study conducted by Hassan *et al.* which states that laryngoscopy stimulates the proprioceptors at the base of tongue leading to impulse dependent increase of pressor response and catecholamine concentration and subsequent orotracheal intubation recruits additional receptors that augment the hemodynamic and catecholamine responses to laryngoscopy [17].

Our study is also in accordance with a study conducted by Ganzouri *et al* who compared the pressor responses of proseal LMA using index finger/introducer tool technique with those of endotracheal intubation. They concluded that endotracheal intubation is associated with significant pressor response, while it is minimal with the use of proseal LMA with standard technique [18].

Similarly, Evan *et al.*, while evaluating proseal LMA using index finger/introducer tool technique, observed minimal hemodynamic response to its insertion in their patients. On the other hand, laryngoscopic assisted PLMA guided placement of PLMA in our study was associated with significant pressor response [19].

Two reasons can be elicited for this discrepancy of observation. One obvious reason is that we used laryngoscopic assisted GEB guided technique for PLMA placement, while Evan *et al* used conventional index finger or introducer tool technique. Another reason is difference in method of induction in two studies. While we used sleep dose of thiopentone and vecuronium bromide for induction, Evan *et al.* also used fentanyl and propofol for induction of anesthesia in their study.

Braun *et al.* reported that using standard technique hemodynamic responses to PLMA insertion and classic LMA insertion were similar [20]. Jung *et al.*, while evaluating laryngeal mask airway in children, reported that classic LMA, when inserted using laryngoscopic guidance, is associated with greater hemodynamic response as compared to, when inserted using index finger technique [21].

We did not measure the forces required for laryngoscopy and catecholamine concentration variations in response of PLMA/ETT placement in our study due to lack of facility in our institute.

It can be postulated from our study that laryngoscopic assisted GEB guided placement of PLMA is associated with pressor response, which is although lesser than laryngoscopy followed by intubation, but greater than proseal LMA when inserted using standard technique.

CONCLUSION

This study suggests that GEB primed proseal laryngeal mask airway when placed under laryngoscopic guidance, is associated with pressor response in the form of increase in heart rate and blood pressure. However, this pressor response is of milder magnitude and lasts for lesser duration as compared to laryngoscopy and intubation.

REFERENCES

1. Brain AIJ. The laryngeal work – A new concept in airway management. *Br J Anaesth.* 1983; 55: 801-4. [https://doi: 10.1093/bja/55.8.801](https://doi.org/10.1093/bja/55.8.801)
2. Griffin RM, Hatcher IS. Aspiration pneumonia and the laryngeal mask airway. *Anaesthesia.* 1990; 45: 1039-40. <https://doi.org/10.1111/j.1365-2044.1990.tb14882.x>
3. Brain AIJ, Verghese C, Strube PJ. The LMA 'Proseal' – a laryngeal mask with an oesophageal vent. *Br J Anaesth.* 2000; 84: 650-4. [https://doi:10.1093/bja/84.5.650](https://doi.org/10.1093/bja/84.5.650)
4. Brimacombe J, Keller C. The proseal laryngeal mask airway, a randomised, cross over study with the standard laryngeal mask airway in paralyzed, anesthetized patients. *Anesthesiology.* 2000; 93: 104-9. <https://doi.org/10.1097/0000542-200007000-00019>

5. Keller C, Brimacombe J. Mucosal pressure and oropharyngeal leak pressure with the proseal versus laryngeal mask airway in anaesthetized paralysed patients. *Br J Anaesth.* 2000; 85(2): 262-6. <https://doi.org/10.1093/bja/85.2.262>
6. Proseal LMA. Instruction Manual. Henley-on-Thames: The Laryngeal Mask Airway Company Ltd.; 2000. <https://doi.org/10.1097/00000542-200007000-00019>
7. Howath A, Brimacombe J, Keller C. Gum elastic bougie-guided insertion of the Proseal™ Laryngeal Mask Airway: A new technique. *AnaesthIntens Care* 2002; 30: 624-7. <https://doi:10.1177/0310057X0203000514>
8. Brimacombe J, Keller C. Gum elastic bougie-guided insertion of the Proseal™ Laryngeal Mask Airway. *AnaesthIntens Care.* 2004; 32: 681-4. <https://doi:10.1177/0310057X0203000514>
9. Brimacombe J, Keller C, Judd DV. Gum elastic bougie guided insertion of the Proseal™ laryngeal mask airway is superior to the digital and introducer tool techniques. *Anaesthesia.* 2004; 100: 25-9. <https://doi: 10.1097/00000542-200401000-00008>
10. Howath A, Brimacombe J, Keller C. Gum elastic bougie-guided insertion of the Proseal™ Laryngeal Mask Airway: A new technique. *AnaesthIntens Care.* 2002; 30: 624-7. <https://doi.org/10.1097/00000542-200401000-00008>
11. Brimacombe J, Keller C, Judd DV. Gum elastic bougie guided insertion of the Proseal™ laryngeal mask airway is superior to the digital and introducer tool techniques. *Anaesthesia.* 2004; 100: 25-9. <https://doi.org/10.1097/00000542-200401000-00008>
12. McCoy EP, Mirakheir RK, McCloskey BV. A comparison of the stress response to laryngoscopy – The Macintosh versus the McCoy blade. *Anaesthesia.* 1995; 50: 943-6. <https://doi:10.1111/j.1365-2044.1995.tb05924.x>
13. Howath A, Brimacombe J, Keller C. Gum elastic bougie-guided insertion of the Proseal™ Laryngeal Mask Airway: A new technique. *AnaesthIntens Care.* 2002; 30: 624-7. <https://doi.org/10.1097/00000542-200401000-00008>
14. Ganong WF. *The autonomic nervous system (Review of Medical Physiology).* 1987; ed. 13th 183-8. <https://doi.org/10.1097/00000542-200401000-00008>
15. Howath A, Brimacombe J, Keller C. Kihara gum elastic bougie guided placements of proseal laryngeal mask. *Can J Anesth.* 2002; 49(5): 528-9. <https://doi:10.1007/BF03017942>
16. Yakaitis RW, Blitt CD, Angiul JP. End tidal halothane concentration for endotracheal intubation. *Anesthesiology.* 1977; 47: 386-8. <https://doi:10.1097/00000542-197901000-00017>
17. Hassan HG, ed-Sharkawy TY, Renck H, Mansour G, Fouda A. Hemodynamic and catecholamine responses to laryngoscopy with Vs without endotracheal intubation. *ActaAnaesthesiol Scand.* 1991; 35 (5): 442-7. <https://doi.org/10.1097/00000542-200401000-00008>
18. Ganzouri AE, Avramov MN, Budac S, Moric M, Tuman KJ. Proseal laryngeal mask airway versus endotracheal tube: Ease of insertion, hemodynamic responses and emergence characteristics: *Anesthesiology.* 2003; 99: A571 (Abstract). <https://doi.org/10.1097/00000542-200401000-00008>
19. Evans NR, Gardner SV, James MFM, King JA, Roux P, Bennett P, Nattrass R, Llewellyn R, Visu D. The Proseal laryngeal mask: results of a descriptive trial with experience of 300 cases. *Br J Anaesth.* 2002; 88(4): 534-9. <https://doi.org/10.1093/bja/88.4.534>
20. Braun U, Zerbst M, Fulle Krug B, Gentzel I, Hempel V. A comparison of the proseal laryngeal mask to the standard laryngeal mask on anaesthetized, non-relaxed patients (German): *AnesthesiolIntensivmedNotfallmedSchmerzther.* 2002; 37(12): 727-33. <https://doi:10.1055/s-2002-35911>
21. Jung KW, Cho CK, Yang HS. Clinical investigation of laryngeal mask airway in children (Korean). *Korean J Anesthesiol.* 1993; 26(4): 763-9. <https://doi: 10.4097/kja.d.18.00121>