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Comparison of intubating LMA and I-gel for ease of insertion and as a conduit for endotracheal intubation

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***Abstract*---**Background: A recently introduced supraglottic airway device (SAD) has been claimed to be an efficient supraglottic airway. It can also be used as a conduit for endotracheal intubation. However, LMA frequently used for this purpose; hence in this randomized study, success rate of blind tracheal intubation through two different SADs i-gel and LMA was evaluated. Methods: This is a prospective study was conducted in the Department of Anesthesia at Tertiary Care Center Teaching among 180 patients fulfilling the criteria. Fasting patients with ages 20-50 years undergoing elective procedures under general anesthesia with ASA physical status 1 and 2 and Mallampatti class I and II were included in the study. Whereas patients with ASA physical status 3 or 4, and having contraindications to insertion of LMA or i-gel™ such as; mouth opening less than 2 cm, increased risk of aspiration, anticipated difficult intubation and facemask ventilation, with Mallampatti class III to IV were excluded. Results: The 180 patients selected for the study were randomized into two groups of 90 each. One of the group was administered the I-gel (Group A) and the other group was given I-LMA (Group B). It was observed that insertion I-gel was easy in 76 out of 90 patients. Difficult insertion took place in 14 patients. It was observed that ILMA insertion was easy in 82 out of 90 patients. Difficult to insertion took place in 9 patients. The comparison of ease of insertion between the two groups did not reveal any statistical significance (p>0.05). It was

observed that the respective devices were successfully placed in all patients in both the groups and no patients required third attempt. I-gel was placed in first attempt in 80 out of 90 patients, 10 patients needed second attempt. The I-LMA was placed in first attempt in 75 out of 90 patients. 15 patients required second attempt for insertion and no patients required third attempt. Conclusion: We concluded I-gel aids easy and rapid insertion as a supraglottic airway device, but when it is used as a conduit for blind endotracheal intubation, the failure rate is high as there is more incidence of oesophageal intubation. On the contrary, ILMA being a gold standard device meant for intubation guide has a high first attempt success rate for blind endotracheal intubation.

***Keywords*---**Difficult intubation, Supraglottic devices, I-gel, ILMA.

Introduction

Endotracheal intubation is a definitive way of securing the airway and is routinely done by laryngoscopy and visualization of cords. [1] However, this involves distortion of upper airway to bring glottis into the line of sight and in some situations such as high larynx, facial trauma, etc., tracheal intubation fails. [2] Supraglottic airway devices (SADs) are useful in such situations for rescue ventilation. [3] Laryngeal mask airway (LMA) classic (c-LMA) is one such device which is included in Difficult Airway Society guidelines for unanticipated difficult intubation. [4]

Laryngeal mask airway classic was designed for maintenance of airway in emergency situations, especially by untrained personnel. Later it was modified into intubating LMA (ILMA) or LMA Fastrach. [5] Major difference between standard LMA and LMA Fastrach lies in the design and function of the shaft which is rigid as compared to soft silicone shaft of c-LMA thus facilitating adjusting manoeuvres to align the mask's aperture against the glottis opening. [6]

The i-gel is a relatively new single-use SAD which does not have an inflatable cuff. [7] It is made from a soft, i-gel-like and transparent thermoplastic elastomer (styrene ethylene butadiene styrene) which creates a noninflatable seal which is a mirror impression of the supraglottic anatomy. [8] The i-gel has several other useful design features including a gastric channel, an epiglottic ridge and a ridged flattened stem to aid insertion and reduce the risk of axial rotation. [9] The stem of the i-gel is less flexible than that of the LMA-classic and has an integral bite. [10] i-gel has also been used in rescue airway management and as a conduit for tracheal intubation. [11]

The aim of our study was to compare the success rate of blind tracheal intubation through the i-gel versus the LMA Fastrach. Because of higher airway leak pressure and better visualization of glottis, as compared to LMA Fastrach, we assumed a better first-attempt success rate during blind tracheal intubation through i-gel.

Materials and Methods

This is a prospective study was conducted in the Department of Anesthesia at Tertiary Care Center Teaching among 180 patients fulfilling the criteria. Fasting patients with ages 20-50 years undergoing elective procedures under general anesthesia with ASA physical status 1 and 2 and Mallampatti class I and II were included in the study. Whereas patients with ASA physical status 3 or 4, and having contraindications to insertion of LMA or i-gel™ such as; mouth opening less than 2 cm, increased risk of aspiration, anticipated difficult intubation and facemask ventilation, with Mallampatti class III to IV were excluded.

Patients were divided into two groups by random allocation based on computer generated table of random numbers. After collection of demographic and anthropometric data patients were brought to the operating room and clinically indicated monitoring was installed. After adequate oxygen administration both groups received inj. midazolam 0.5 mg/kg, inj. nalbuphine 0.1 mg/kg and inj. ondansetron 0.1 mg/kg before induction of anesthesia with inj. propofol 1-2 mg/kg and inj. atracurium 0.5 mg/kg IV. Patient were mechanically ventilated with 3-5% sevoflurane vapors in 100% oxygen for three minutes through face mask.

Group A was inserted with LMA group. After confirmation of adequate seal and ventilation through capnography and anaesthesia machine, appropriate sized endotracheal tubes (ETT) was inserted through it according to the recommendations by the manufacturer. After inflation of the cuff of ETT, correct placement and adequate ventilation was checked through capnography.

Group B was inserted with i-gel™. After confirmation of adequate seal and ventilation, appropriately sized ETT was inserted through it. After inflation of cuff of the ETT, correct placement and adequate ventilation was checked through capnography.

Once the correct placement of ETT was confirmed, the supraglottic device was removed over the ETT with the help of removal stylet and the procedure was marked as successful. The ventilation was continued through the SGD if intubation was failed.

Anesthesia was maintained on 2-3% sevoflurane in a mixture of 50% air and 50% O2. Boluses of inj. atracurium were used for muscle relaxation on as required basis. Patients were monitored for blood pressure, heart rate, oxygen saturation and electrocardiogram. At the end of the surgery, on return of muscle power, residual neuromuscular blockade was reversed by inj. neostigmine 30 µg/kg plus glycopyrrolate IV. On complete recovery, SGD or the ETT was removed and the patient was given oxygen by a face mask.

Statistical analysis:

The success rate of tracheal intubation on the first attempt with LMA as reported in previous RCT was 63% compared with 15% of i-gel. SPSS version 25 was used for data analysis. Mean and standard deviations were calculated for quantitative

variables like age and weight. For categorical data like, gender, ASA & mallampatti classification and successful intubation percentages were calculated after stratification.

Results

A total of 180 normotensive adult patients were taken for this study, where the cardiovascular changes, efficacy of positive pressure ventilation, emergence and complications if any were observed and compared between patients receiving the I-gel and I-LMA taken up for elective operation of duration between 60 to 90 minutes. The effects were observed by monitoring heart rate, blood pressure and spo2 preoperatively (as baseline), after placement of endotracheal tube via I-gel or I-LMA at 1 min, 3 mins, 5mins,10mins then at removal of the device and 5 mins after removal. For both the groups baseline etco2 was taken from connection of etco2 cable following placement of airway devices.

Table 1: The demographic data of the patients

GROUP A	**GROUP B**
Number of cases-90	Number of cases-90
Mean age – 45.47±7.77 (years)	Mean age – 46.47±7.69
Mean weight -61.91±8.77	Mean weight -58.91±5.74
Sex (M:F) – 51:39	Sex (M:F) – 48:42
Mean±SD BMI- 24.55±3.74 (kg/m2)	Mean±SD BMI- 24.91±3.68

Both groups shown statistically not significant difference in weight but both the groups were comparable in terms of mean age, sex distribution, and BMI. The 180 patients selected for the study were randomized into two groups of 90 each. One of the group was administered the I-gel (Group A) and the other group was given I-LMA (Group B).

Table 2: Distribution of patients according to ease of insertion of airway devices in both the groups

Ease of insertion	**GROUP A**		**GROUP B**	
	No of patients	**Percentage**	**No of patients**	**Percentage**
Easy	76	84.4%	82	91.1%
Difficult	14	15.6%	9	08.9%
Failed	0	0%	0	0%
Total	90	100%	90	100

It was observed that insertion I-gel was easy in 76 out of 90 patients. Difficult insertion took place in 14 patients. It was observed that ILMA insertion was easy in 82 out of 90 patients. Difficult to insertion took place in 9 patients. The comparison of ease of insertion between the two groups did not reveal any statistical significance ($p>0.05$).

Table 3: Number of insertion attempts (supraglottic airway devices) required in both the groups

	GROUP A			GROUP B		
No of attempts	1	2	3	1	2	3
No of patients	80	10	0	75	15	0
% of patients	88.9	11.1	0	83.3	16.7	0

It was observed that the respective devices were successfully placed in all patients in both the groups and no patients required third attempt. I-gel was placed in first attempt in 80 out of 90 patients, 10 patients needed second attempt. The I-LMA was placed in first attempt in 75 out of 90 patients. 15 patients required second attempt for insertion and no patients required third attempt. The comparison of ease of insertion attempts between the two groups did not reveal any statistical significance ($p>0.05$).

Table 4: Number of insertion attempts (endotracheal tube) required in both the groups

	GROUP A			GROUP B		
No of attempts	1	2	3	1	2	3
No of patients	50	25	15	65	11	14
% of patients	55.6	27.7	16.7	72.2	12.2	15.6

It was observed that the respective devices were successfully placed in all the patients in both the groups. Endotracheal tube via I-gel was placed in first attempt in 50 out of 90 patients, 25 patients required second attempt for insertion and 15 required third attempt. The ILMA was placed in first attempt in 65 out of 90 patients, 11 patients required second attempt and 14 patients required third attempts. The comparison of insertion attempts between the two groups did not reveal any statistical significance ($p>0.05$).

Table 5: Time taken for placement of endotracheal tube in both the groups

Time for insertion (in seconds)		
GROUP	**MEAN**	**SD**
GROUP A	27.29	3.75
GROUP B	24.23	3.85
Overall	26.21	4.33

The mean time required for insertion of ET tube in both the groups the mean time taken for insertion of ET tube in group G was 27.29 seconds. The mean time taken for insertion of ET tube in group L was 24.23 seconds. The calculated p value was >0.01 and by conventional criteria this difference is not considered statistically significant.

Table 6: Time taken for placement of supraglottic airway devices in both the groups

Time for insertion (in seconds)		
GROUP	**MEAN**	**SD**
GROUP A	24.26	4.67
GROUP B	21.36	4.44
Overall	23.32	4.99

The mean time required for insertion of respective devices in both the groups. The mean time taken for insertion of I-gel in group G is 24.26 seconds. The mean time taken for insertion of I-LMA was 21.36 seconds. The calculated p value <0.01 by conventional criteria this difference is considered to be statistically significant.

Discussion

The mean age, weight and sex ratio were comparable in both the groups. Our study showed that the I-gel, as a ventilatory device was as effective as ILMA in maintaining the ventilation and oxygenation in the anesthetized patients with the normal airway. The mean insertion time for the supraglottic airway device was significantly less for I-gel in comparison with ILMA. The I-gel being an uncuffed perilaryngeal sealer, the insertion was easy and quick. It also provided a reliable airway. Both I-gel and ILMA were successfully inserted in all patients. The overall success rate for supraglottic airway device insertion was similar in both the groups. The result obtained with I-gel was comparable with that obtained by Gatward JJ. [12]

The device was ease inserted of airway devices 76 patients in I-gel and 82 patients in ILMA with no significant difference. Choosing the size of the supraglottic airway device was more important as inappropriate sizing could lead to a significant reduction in the first attempt success rate for insertion of the device. The size of the supraglottic airway device predominantly used in the study was, a majority of the patients‟ weight was in the range of 50- 70 kg. There were no adverse airway events recorded during placement of the supraglottic airway device. The overall success rate of blind endotracheal intubation through ILMA with conventional PVC tubes with curvature facing downwards in patients with Mallampatti 1 and 2 was 95% and was significantly higher than in I-gel (72.5%). Joo & Rose [13] reported 96.7% overall intubation success rate with the reverse orientation of conventional PVC tracheal tubes through ILMA in patients with the normal airway. Kendra. [14] demonstrated a 96% success rate within two intubation attempts with both Rusch PVC tubes oriented in the normal direction and with silicone wire-reinforced tubes. Michalek. [15] compared the I-gel and ILMA as a conduit for tracheal intubation in manikin and concluded that the success rate for blind tracheal intubation through ILMA was over 80% and I-gel was 63%.

The first-attempt success rate is another important performance indicator for tracheal intubation. The first attempt success rate of blind endotracheal intubation through ILMA was 72.2% similar to that obtained by Joo and Rose [16] through I-gel was 55.6%. The first attempt success rate of blind endotracheal

intubation was significantly high in the ILMA. The curved shape of the ILMA stem which directs the tube anteriorly and the adjusting Chandy maneuver of ILMA used before intubation probably improved the success rate. [11] An important factor that determines the success rate of tracheal intubation is the angle at which the tracheal tube emerges from the distal aperture of the ILMA and I-gel. Tracheal intubation via an ILMA with the conventional tracheal tube inserted in reverse orientation was first described by Joo and Rose. [17] The reverse orientation of the conventional PVC endotracheal tubes through ILMA reduced the emerging angle of the tube from the ILMA (from 40º to 20º) and improved the success rate of intubation even though the silicone reinforced tube was not used. P. Michalek, had observed the same findings in his study. The incidence of the esophageal intubation was common with I-gel. The reason attributed to this was the relatively straight shape of the I-gel stem which has a tendency to direct them posteriorly and thus increase the risk of oesophageal intubation or snaring on the arytenoids had cited that inappropriate positioning of the ILMA in relation to the glottis, as assessed by the fibre-optic view, as the reason for an increase in the number of attempts and the incidence of failure to achieve tracheal intubation.

The mean time required for successful tracheal intubation in the first attempt was similar in both the groups. Anitha Shetty, had obtained similar results with ILMA. The I-gel has a wider stem. Danha, suggested that wider shaft of the channel and absence of bar make the tube passage „subjectively easy". The time required for the supraglottic device removal after intubation was significantly less in the I-gel group. This uncuffed device was easier to remove with endotracheal tube in situ using a stabilizing rod. Sharma, described difficulties in removing the I-gel after intubation, but we have not noted any significant difficulties by using the silicone stabilizing rod from the ILMA set. The total time required for successful endotracheal intubation (including Airway insertion time, intubation time and removal of airway device) was equal in both the groups showing no statistically significant difference.

The mean time required inserting the ET Tube in both the groups for I-gel was 27.29 ± 29 second and ILMA was 24.23 ± 3.85 seconds. The mean insertion time of ET Tube and I-gel by other studies are listed below Kannaujia A *et al.* in his study in 2009 showed that median insertion time for I-gel is 11 seconds. [18]

Based on the results of our study, I-gel aids easy and rapid insertion as a supraglottic airway device, but when it is used as a conduit for blind endotracheal intubation, the failure rate is high as there is more incidence of oesophageal intubation. On the contrary, LMA being a gold standard device meant for intubation guide has a high first attempt success rate for blind endotracheal intubation. LMA is superior to i-gel as a conduit for blind endotracheal intubation because of its overall higher success rate. However, the statistically similar success rate in first attempt of tracheal intubation and the significantly lesser time required for insertion of i-gel make it a reasonable alternative to LMA for intubation and an excellent choice for rescue ventilation. So, LMA is a better device for blind intubation but as far as rescue ventilation is concern i-gel is better due to its easy and quick insertion.

Conclusion

We conclude that, based on the results of our study, I-gel aids easy and rapid insertion as a supraglottic airway device, but when it is used as a conduit for blind endotracheal intubation, the failure rate is high as there is more incidence of oesophageal intubation. In the contrary, ILMA being a gold standard device meant for intubation guide has a high first attempt success rate for blind endotracheal intubation.

References

1. Brain AI, Verghese C, Addy EV, Kapila A. The intubating laryngeal mask. I: Development of a new device for intubation of the trachea. Br J Anaesth 1997;79:699-703.
2. Brain AI. The laryngeal mask – A new concept in airway management. Br J Anaesth 1983;55:801-5.
3. Henderson JJ, Popat MT, Latto IP, Pearce AC, Difficult Airway Society. Difficult Airway Society guidelines for management of the unanticipated difficult intubation. Anaesthesia 2004;59:675-94.
4. i-gel User Guide. 7th ed. Wokingham, UK: Intersurgical Ltd.; 2009.
5. Levitan RM, Kinkle WC. Initial anatomic investigations of the i-gel airway: A novel supraglottic airway without inflatable cuff. Anaesthesia 2005;60:1022-6.
6. Uppal V, Gangaiah S, Fletcher G, Kinsella J. Randomized crossover comparison between the i-gel and the LMA-Unique in anaesthetized, paralysed adults. Br J Anaesth 2009;103:882-5.
7. Lee JR, Kim MS, Kim JT, Byon HJ, Park YH, Kim HS, et al. A randomised trial comparing the i-gel (TM) with the LMA Classic (TM) in children. Anaesthesia 2012; 67:606-11.
8. Michalek P, Hodgkinson P, Donaldson W. Fiberoptic intubation through an i-gel supraglottic airway in two patients with predicted difficult airway and intellectual disability. Anesth Analg 2008;106:1501-4.
9. Namita Saraswat, Aditya Kumar, Abhijeet Mishra , Amrita Gupta , Gyan Saurabh , and Uma Srivastava; The comparison of Proseal laryngeal mask airway and endotracheal tube in patients undergoing laparoscopic surgeries under general anaesthesia, Indian J Anaesth. 2011;55:129–134.
10. Kapoor S, Jethava DD, Gupta P, Jethava D, Kumar A. Comparison of supraglottic devices i-gel® and LMA Fastrach® as conduit for endotracheal intubation. Indian J Anaesth. 2014;58:397 -402
11. i-gel User Guide. 7th ed. Wokingham, UK: Intersurgical Ltd.; 2009.
12. Levitan RM, Kinkle WC. Initial anatomic investigations of the i-gel airway: A novel supraglottic airway without inflatable cuff. Anaesthesia 2005;60:1022-6.
13. Uppal V, Gangaiah S, Fletcher G, Kinsella J. Randomized crossover comparison between the i-gel and the LMA-Unique in anaesthetized, paralysed adults. Br J Anaesth 2009;103:882-5.
14. Lee JR, Kim MS, Kim JT, Byon HJ, Park YH, Kim HS, et al. A randomised trial comparing the i-gel (TM) with the LMA Classic (TM) in children. Anaesthesia 2012; 67:606-11.

15. Michalek P, Hodgkinson P, Donaldson W. Fiberoptic intubation through an i-gel supraglottic airway in two patients with predicted difficult airway and intellectual disability. Anesth Analg 2008;106:1501-4.
16. Campbell J, Michalek P, Deighan M. i-gel supraglottic airway for rescue airway management and as a conduit for tracheal intubation in a patient with acute respiratory failure. Resuscitation 2009;80:963.
17. Danha RF, Thompson JL, Popat TM, Pandit JJ. Comparison of fibreopticguided orotracheal intubation through classic and single-use laryngeal mask airways. Anesthesia, 2005; 60: 184–8.
18. McNeillis NJD, Timberlake C, Avidan MS. Fibreoptic views through the laryngeal mask and intubating laryngeal mask. European Journal of Anaesthesiology, 2001; 18: 471–5.