Original article:

A comparative study of tracheal intubation through two different supraglottic airway devices

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ABSTRACT

Background: Tracheal intubation with Macintosh laryngoscope is considered as the "gold standard" in airway management. Supraglottic airway devices (SAD) are helpful in difficult airways and in emergency life threatening situations. SAD like Intubating laryngeal mask airway (ILMA) and I-gel are useful for tracheal intubation using blind or a fibreoptic guided technique .

Methods : Eighty patients scheduled for elective surgeries were divided into two groups of 40 each.All patients received premedication followed by balanced general anesthesia.SAD were inserted; in group A (I-gel), in group B (ILMA) and blind endotracheal intubation was done through SAD. Number of attempts and time required for SAD insertion, attempts and time required for endotracheal intubation were recorded.

Results: First attempt success rate of SAD insertion in I-gel group 90% as compared to ILMA group 82.5%.SAD insertion time was less in I-gel group 15.73± 6.50 secs as compared to ILMA group 31.85 ± 4.84 secs.Endotracheal intubation success rate at first attempt in ILMA group 67.5% & I-gel group 57.5%. Endotracheal intubation time in I-gel group 26.66± 10.07 seconds , ILMA group 32.85± 6.05 seconds. Overall success rate of endotracheal intubation was more in I-gel group (87.5%) than ILMA group (85%). Postoperatively dysphagia and sore throat was lesser in I-gel group.

Conclusion: I-gel and ILMA were found useful alternative to conventional laryngoscope for tracheal intubation. I-geI had better success rate in tracheal intubation with less occurrence of complications.

Key words: Anesthesia, Technique, I-gel, ILMA, Endotracheal conduit

INTRODUCTION:

Tracheal intubation with Macintosh laryngoscope is considered as the "gold standard" in airway management (Macintosh,1943).[1]Supraglottic airway devices are novel devices that provide greater control of the airway than the face mask without disadvantages of the invasive technique of endotracheal tube. They are helpful in managing anticipated and unanticipated difficult airway and can be used as a ventilating devices and as a conduit for endotracheal intubation.The new versions of supraglottic airway devices like I-gel and ILMA allow easy placement with predictable ventilation, minimize the chances of pulmonary aspiration and serve as a conduit for endotracheal intubation.[2]

G. Bhandari et al[1] concluded from their study that both the supraglottic airway devices, I-gel and ILMA were proved to be useful alternative to conventional laryngoscope for tracheal intubation though I-gel had better success rate as compared to ILMA.

Priyamvada Gupta et al[4] concluded from their study that I-gel can be used as a conduit for endotracheal intubation. Though it is an effective supraglottic airway device, it is slightly inferior to intubating LMA as the intubating device. Thus acknowledging the study of various authors, this study was designed to compare success rate at first attempt of blind tracheal intubation through I-gel and ILMA and any complications related to the procedure.

OBJECTIVES

Aprospective randomizedstudy of tracheal intubation using IGEL and ILMA was done to evaluate

1. First attempt success rate and time for insertion of SAD.
2. Success rate at first attempt for tracheal intubation using I-geland ILMA.
3. Compare tracheal intubation time andoverall success rate through I-gel and ILMA.
4. Hemodynamic parametersand postoperative complications.

METHODS

After the approval of institutional ethical committee and written informed consent, the patients were divided into 2 groups of 40 each by computer generated random numbers -Group A: Endotracheal intubation using Igel,Group B : Endotracheal intubation using Intubating Laryngeal Mask Airway.INCLUSION CRITERIA – Age : 16 to 60 years,ASA:Grade I and II, Sex : Male and Female, posted for elective surgery under general anesthesia lasting maximum 2 hrs. EXCLUSION CRITERIA– Mouth opening < 2 centimeter,Modified mallampatti class 3 and 4,Body Mass Index > 35 kg/m2, Airway surgery,Upper respiratory tract pathology ,Gastro-esophageal reflux disease,Patients with hiatus hernia,Pregnancy, cervical spine disease, other systemic illness.

ANESTHESIA TECHNIQUE: Thorough preoperative anesthesia assessment and laboratory reports were confirmed. All patients were confirmed for nil by mouth for 6 hours. Premedicated with Inj.Glycopyrrolate 0.2 mg IM and Inj.Ranitidine 1 mg/kg IV, 30 minutes before induction.IVfluid ringer lactate was started. Patients were connected to monitors (ECG, SPO2, NIBP, ETCO2). Pre induction pulse rate, blood pressure, respiratory rate, SPO2 was recorded. All patients received intravenous midazolam 0.03 mg/kg, 10 minutes before induction of general anesthesia. After pre oxygenation with 100% oxygen for three minutes, intravenous induction was done with Inj.Thiopentone 2.5% 3-5 mg/kg ,Muscle relaxation was facilitated with Inj.Suxamethonium 2mg/kg IV.Then according to body weight the sizes of the SADs (I-gel / ILMA) and endotracheal tube were chosen: I-gel size 3 for 30-50 kg wt, I-gel size 4 for 50-90 kg wt, ILMA size 3 for 30-50 kg wt, ILMA size 4 for 50-70 kg wt, ILMA size 5 for 70-90 kg wt.

Polyvinylchloride cuffedendotracheal tube was used for blind tracheal intubation through the Supraglottic Airway Device.SADs and ETT were lubricated with 2% lignocaine jelly prior to use. The Igel was inserted in extended neck position in group A, while the ILMA was inserted in neutral neck position in group B. Duration of successful SAD insertion was defined as the time elapsed from the insertion of SAD between the dental arches until the confirmation of successful ventilation determined by chest wall movement, auscultation of breath sounds, capnography and absence of oropharyngeal leak..The number of attempts required for SAD insertion were recorded. A failed attempt was defined as removal of the device from the mouth before reinsertion.If the device was not successfully inserted in second attempt this was recorded as failure of SAD insertion.

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After achieving successful ventilation with SAD, blind tracheal intubation was attempted through SAD. When resistance was felt during ETT insertion, following maneuvers were tried in I-gel group:1.Twisting of the tracheal tube to align the bevel, upand down movement of thetracheal tube gently within the SAD.2.Cricoid pressure.If resistance was encountered during insertion of tracheal tube in ILMA group, a standardized algorithm was followed on the basis of the distance at which the resistance was felt, as recommended by manufacturer (Brain et al, 1997; Kihara et al, 2002). If no resistance was felt during insertion of tracheal tube it was advanced fully into the SAD. **Duration of successful blind tracheal intubation** through SAD was defined as the time elapsed from passing the ETT through SAD untill the confirmation of successful ventilation, which was determined by chest rise, auscultation of breath sounds and capnography. In both the groups, SAD was kept in situ.

Anesthesia was maintained with O2 and N2O (50:50), sevoflurane on controlled ventilation via Bain's circuit and using vecuronium bromide as neuromuscular blocking agent in all patients.Intraoperatively heart rate, blood pressure, ECG, ETCO2 and SPO2 was monitored.Inj.Neostigmine 0.04 mg/kg and Glycopyrrolate 0.01 mg/kg IV given to reverse the neuromuscular blockade after completion of surgery.

Thorough inspection was done for any mucosal injury, dental injury and blood mixed secretions over SAD and endotracheal tube at the time of its removal. In post-operative period, patients were assessed for sore throat and dysphagia, dysphonia and hoarseness of voice.

STATISTICAL ANALYSIS: Data analysis was performed with statistical software SPSS version 16. Microsoft Word and Excel have been used to generate graphs, tables etc. In comparing categorical variables, Chi square test was used as tests for statistical comparison. Independent sample t test was employed in assessing statistical significance of two continuous variables.At 95% confidence interval, $p<0.05$ was considered significant.

OBSERVATIONS:

Table I: Demographic data

Variable	Group IGEL	Group ILMA	p-value
Age (years) mean ±SD	38.08 ± 12.61	40.78 ± 12.27	0.335
Sex (male/female)	19/21	20/20	0.999
Weight (kg) mean ± SD	61.73 ± 7.59	59.66 ± 6.40	0.191
Height (m) Mean ± SD	1.58 ± 0.06	1.60 ± 0.06	0.22
BMI (kg/m2) Mean ± SD	24.30 ± 2.58	23.29 ± 1.95	0.051
MPC grading (I/II)	30/10	27/13	0.622
ASA grading (I/II)	21/9	26/14	0.323

Notes: ILMA= Intubating Laryngeal Mask Airway, SD=Standard Deviation, BMI=Body Mass Index, MPC=Mallampati Classification, ASA=American Society of Anesthesiologists

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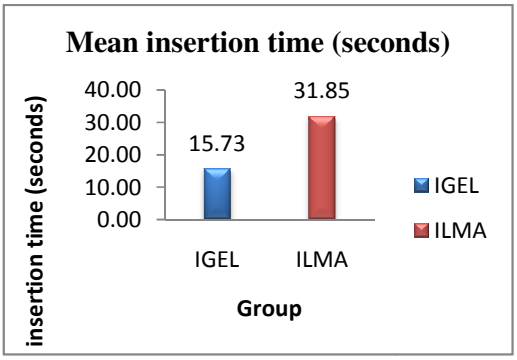
By using 2 independent sample t-test p-value > 0.05, therefore there were no significant differences in above demographic variables.

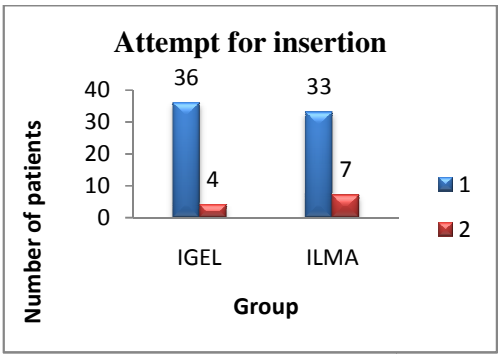
Table II: Insertion time, attempts required and success rate of Supraglottic airway device insertion and endotracheal intubation

SAD insertion	IGEL group	ILMA group	P value	Conclusion
Insertion time (secs) Mean + SD	15.73 ± 6.50	31.85 ± 4.84	< 0.001	Significant
No. Of attempts (1/2)	36 / 4	33 / 7	0.517	Not significant
Endotracheal Intubation				
Insertion time (secs) mean +SD	26.66 ± 10.07	32.85 ± 6.05	0.004	Significant
No. Of attempts (1/2/not possible)	23 / 12 / 15	27 / 7 / 6	0.421	Not significant
Overall success rate (failure/success)	5 / 35	6 / 34	0.999	Not significant

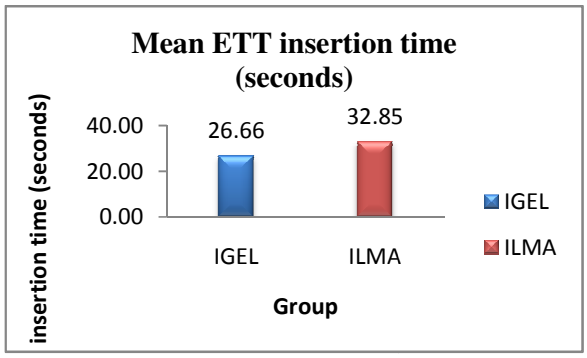
Graph I : Comparison of mean insertion time of SAD



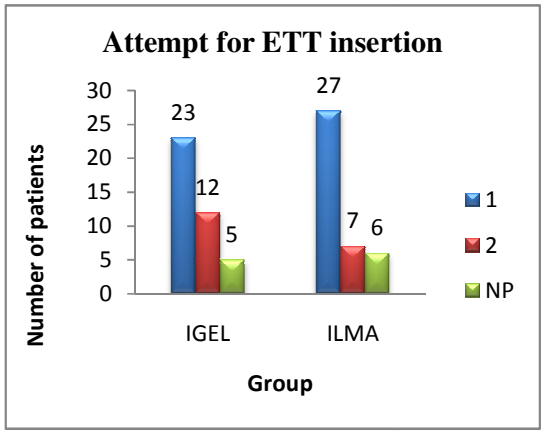
Graph II : Comparison of attempts required for insertion of SAD



Graph III : Comparison of mean time required for endotracheal intubation



Graph IV: Comparison of number of attempts of endotracheal intubation



NP-not possible.

Table III : Postoperative complications

Postoperative complications	Group		Total
	A (IGEL)	B (ILMA)	
No complication	28 (70%)	24 (60%)	52
Sore throat	8 (20%)	10 (25%)	10
Dysphagia	4 (10%)	6 (15%)	18
Dysphonia	0	0	0
Hoarseness	0	0	0
Total	40 (100%)	40 (100%)	80

DISCUSSION:

Demographic data in both groups were comparable with respect to age, sex, weight, height, body mass index, MPC and ASA grading. (Table I).

First attempt success rate of SAD insertion-(Table ll)

First attempt success rate of SAD insertion was better in I-gel group (90%) as compared to ILMA group (82.5%) in our study.(graph ll)

G. Bhandari, et al in 2013[1] conducted a study to compare tracheal intubation through I-gel and ILMA. Supraglottic device insertion first attempt success rate was 95% in group I-gel and 90% in ILMA. They found no statistically significant difference in the successful insertion of Supraglottic Airway Devices between the two groups i.e. I-gel and ILMA with p-value 0.338.Sameer Kapoor, et al in 2014[4] conducted a study to compare supraglottic devices I-gel and LMA Fastrach as conduit for endotracheal intubation. First attempt success rate of SAD insertion was 96% in group I-gel and 90% in group ILMA with p-value of 0.239.

Our study had similar results for success rate of SAD insertion in both the groups.

Time taken for insertion of Supraglottic Airway Device (SAD) (Table II)–

Mean insertion time for I-gel in group A was 15.73 ± 6.50 secs while for ILMA in group B was 31.85 ± 4.84 secs with p value < 0.001 which was statistically significant. Time taken for insertion of I-gel was much lesser.(graph l)

In the study done by G. Bhandari, et al in 2013 (1), time for insertion of SAD was 20.92 seconds in I-gel group and 31.75 seconds in ILMA group ($p < 0.001$) which was statistically significant. They mentioned that this may be due to I-gel being more flexible, soft, non-metallic and with more anatomical curvature as compared to ILMA.The study conducted by Sameer Kapoor, et al in 2014[4], showed that time for insertion with SAD was 19.40 secs in group I-gel and 38.96 secs in group ILMA ($P < 0.001$) which was statistically significant.Bharat Choudhary, et al study in 2016 [2], showed that I-gel required significantly lesser time compared to ILMA (20.92 ± 2.25 secs vs. 31.75 ± 3.62 secs) ($p < 0.001$).

Our study was showing similar results with above studies.

Attempts required for endotracheal intubation (Table II Graph lV)-

While considering both the groups, endotracheal intubation first attempt success rate was 57.5% in group I-gel and 67.5% in group ILMA. Though statistically not significant first attempt endotracheal intubation success rate was better in group B with p value 0.421 (Table II). While **overall success rate of endotracheal intubation** was 87.5% in group A and 85% in group B. So there was no significant association between group I-gel and ILMA in regards to overall endotracheal intubation success rate with p value 0.999.

In the study conducted by Sameer Kapoor, et al in 2014[4], with the first attempt, blind tracheal intubation was successful in 66% cases of I-gel group and in 74% cases in ILMA group. They said that this could be due to a "V" shaped tracheal tube guiding ramp in LMA Fastrach that centralizes the endotracheal tube towards the glottic aperture as the endotracheal tube emerges from the metal shaft and guides it anteriorly to reduce the risk of arytenoids trauma and oesophageal placement and the presence of handle in LMA Fastrach which resulted in stabilization and manipulations which could not be done in I-gel.

Similar results were found in our study.

Overall success rate of endotracheal intubation (Table II)-

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Overall success rate of endotracheal intubation was 87.5% in group A and 85% in group B in our study.In the study conducted by G. Bhandari, et al in 2013[1], overall success rate of endotracheal intubation was 77.5% in group I-gel and 62.5% in group ILMA.Bharat Choudhary, et al in 2016[2], concluded the same that overall success rate of endotracheal intubation through SAD was higher with I-gel (57.5%) as compared to ILMA (52.5%).Our study had similar results.

Time required for endotracheal intubation (Table II Graph lll)-

Mean time required for endotracheal intubation was 26.66 ± 10.07 in group I-gel while it was 32.85 ± 6.05 in group ILMA with p value of 0.004. The difference was statistically significant. Therefore, endotracheal intubation required much lesser time in group I-gel.In G. Bhandari, et al study in 2013[1], time to achieve successful intubation through the SADs was 20.41 seconds in I-gel group as compared to 30.68 seconds in ILMA group, p <0.001.Bharat Choudhary, et al in 2016 [2], showed that time required for endotracheal intubation was significantly shorter in group I-gel than group ILMA (26.30 ± 3.61 secs vs. 33.53 ±13.13 secs) (p < 0.001).Our study showed similar results.

Hemodynamic changes-

Increased HR and SBP was observed after SAD insertion and endotracheal intubation in both groups in our study. HR and SBP returned to baseline at 30th minute in both the groups. At 30th minute after intubation SBP in group I-gel was (111.65 ± 10.167) as compared to group ILMA (116.90 ± 7.537) with p value of 0.011 and this was statistically significant. Both the devices were equally effective in maintaining SpO2and ETCO2.

In the study conducted by Bharat Choudhary, et al in 2016[2],there was a similar hemodynamic response (increased HR and SBP) to SAD insertion and endotracheal intubation through SAD in both groups. Both the devices were equally effective in maintaining SpO2 and ETCO2, similar to that found in our study.

Postoperative complications-(Table lll)

The incidence of post-operative complications was comparable in both the groups. Dysphagia and sore throat was lesser with IGEL group, was statistically insignificant. There was no dysphonia, hoarseness, mucosal injury, dental injury and blood tinged secretions over SAD or endotracheal tube in both the groups.

G. Bhandari, et al in 2013[1], found that the incidence of post-operative complications were comparable in both the groups. The incidence of sore throat was lesser in I-gel group (85%) as compared to ILMA group (90%). Dysphagia was found in 2.5% of patients in both the groups. Dysphonia and hoarseness was absent in both the groups. There was no incidence of mucosal injury, dental trauma and blood tinged secretions over the SAD or endotracheal tube.

Conclusion

1. First attempt success rate of SAD insertion was better in I-gel group as compared to ILMA group.
2. The time required for SAD insertion and Time required for endotracheal intubation was also lesser in I-gel group as compared to ILMA group.
3. Endotracheal intubation success rate at first attempt was more in ILMA group as compared to I-gel group and Overall success rate of endotracheal intubation was more in I-gel group as compared to ILMA group.
4. Hemodynamic changes were not significant in both the groups.
5. Postoperative complications were less in I-gel group. Thus, from this study, it can be concluded that ;

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both the supraglottic airway devices (SADs), I-gel and ILMA were found to be useful alternative to conventional laryngoscope for tracheal intubation and I-geI had better success rate in tracheal intubation as compared to ILMA.

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