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Comparison of ILMA and I-Gel as a Conduit for Blind Endotracheal Intubation

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Abstract
Background & Objectives: *Intubating laryngeal mask airway (ILMA) is a supraglottic airway device (SAD) frequently used as conduit for endotracheal intubation when intubation under direct laryngoscopy is undesirable. A newer SAD i-gel is popular now because of its ease of insertion and performance. It can be used as a conduit for endotracheal intubation also. This study compared the success rate of blind endotracheal intubation through ILMA and i-gel*
Methods: *A total of 86 patients undergoing elective surgery under general anaesthesia were divided in two groups of 43 patients each to receive intubation through the ILMA (Group L) or i-gel (Group G). Anaesthesia was induced and selected SAD was inserted. After confirming adequate ventilation with the SAD, blind endotracheal intubation was attempted through the SAD. Success of intubation was noted and time taken for tracheal intubation was measured. IBM SPSS Statistics 20.0 software was used to analyse the data. P < 0.05 was considered as statistically significant.*
Conclusion: *ILMA 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 ILMA for intubation and an excellent choice for rescue ventilation.*
Keywords- *Intubating laryngeal mask airway; i-gel; Endotracheal intubation; Supraglottic airway device.*

Introduction

Airway management is the prime skill that every anaesthesiologist must possess. Endotracheal intubation is considered the gold standard for securing the airway. Tracheal intubation is done usually under direct visualisation with the help of a laryngoscope, but it may fail in some cases. Supraglottic airway devices (SADs) fill a niche between face mask and tracheal tube in terms of anatomical position, degree of invasiveness and security[8,9]. The first successful SAD, the laryngeal mask airway classic (cLMA, LMA classic) was introduced by Archie Brain in 1989 into clinical practice.[4] It is included in Difficult Airway Society (DAS) guidelines for management of unanticipated difficult intubation and also in 'cannot intubate cannot ventilate' situations. It can be used for rescue ventilation as well as a conduit for tracheal intubation in such conditions.[9] During the last two decades, a variety of SADs have been developed, each with certain specific advantages over others. Intubating LMA (ILMA) or LMA Fastrach is a supraglottic airway device designed specifically to

overcome the limitations associated with tracheal intubation through LMA classic.[10] ILMA is also included DAS guidelines for management of unanticipated difficult intubation.[12] i-gel is a newer SAD made of a gel like thermoplastic elastomer, without an inflatable cuff. It is used for airway management in routine practice increasingly now because of its ease of insertion and high airway seal pressure.[13] It can also be used for rescue ventilation and as a conduit for endotracheal intubation.[5] Successful fibreoptic guided and blind tracheal intubation has been done using both i-gel and ILMA as the conduit.[3,6,7]The studies comparing the time taken for and the success rate of tracheal intubation through ILMA and i-gel has shown variable results. . Few studies have showed that it can also be used as a conduit for blind endotracheal intubation with high success rates. If a similar success rate to ILMA can be achieved for blind endotracheal intubation through i-gel, it could prove to be a more suitable alternative to ILMA for blind endotracheal intubation. So, in our study we compared the success rate of blind endotracheal intubation through ILMA and i-gel.

Materials and Methods

A prospective observational study was done after obtaining approval of Institutional scientific and ethics committees.

Sample size was calculated by using the formula

$n= [(Z\alpha+ Z\beta)^2 \times 2pq]/d^2$

Substituting values for a significant level of 0.05 and a power of 80%

$Z\alpha$ =1.96, $Z\beta$ =0.842, p= (P1+P2)/2, q=(100-p), d = (P1-P2)

Substituting values for P1 and P2 from the study by Sastre JA et al.(55)

$n=[(1.96+0.842)^2\times 2\times 55\times45]/ (70-40)^2$ =43

Informed written consent for anaesthesia was taken from all patients in local language. Patients were randomly allocated into two groups of 43 each to receive intubation through the ILMA (Group L) or I-gel (Group G). SAD insertion and intubation was done by a qualified anaesthesiologist. Subjects were kept fasting for 8hrs. Upon arrival in the operating room, all essential monitors were attached and baseline parameter noted. Intravenous access was established with 18G cannula and intravenous fluid Ringer lactate started. Patients were premedicated with midazolam 0.02mg/kg, glycopyrrolate 0.2 mg, ondansetron 0.1mg/kg and IV morphine 0.1mg/kg IV 15min prior to the surgery. Pre-oxygenation was done with 100 % oxygen for 3 min before induction of anaesthesia. After induction with IV propofol 2 mg/kg, confirmation of successful bag & mask ventilation was done. Neuromuscular blockade was then provided with vecuronium 0.1mg/kg IV and ventilated using 100% oxygen for 180 seconds and the chosen airway device was inserted when muscle relaxation was achieved. 1.5mg/kg of 2% preservative free lignocaine IV was given 90 seconds before insertion of SAD. Anaesthesia was deepened with additional bolus doses of propofol, if needed, depending on hemodynamic parameters.

Selection of size of the ILMA and i-gel was based the weight of the patient[9]. SADs were lubricated with water based lubricating jelly prior to insertion. ILMA was inserted in neutral neck position and i-gel in sniffing position. After insertion of SAD, adequate ventilation was confirmed by auscultation, chest movements and $EtCO_2$ waveforms. If ventilation was not adequate, up and down manoeuvre to change depth of insertion was tried. SAD of a different size was tried for the next attempt if it failed to establish adequate ventilation. After adequate ventilation was established, wire-reinforced cuffed endotracheal tubes lubricated with water based jelly were used for blind tracheal intubation in both groups. Size 6 mm ID ETT was used in patients weighing < 50kg and 7mm ID ETT in patients weighing>50 kg.

In group L, on encountering resistance during insertion of tracheal tube in the first attempt, a standardized algorithm was followed for the next attempt on the basis of distance at which resistance was felt[7]. If there was no resistance felt, ETT was fully advanced into ILMA. A successful intubation was confirmed by chest rise, auscultation and capnography.

In group G, if there was resistance during insertion of ETT in the first attempt, i-gel position was adjusted and stabilized at the point of maximum chest expansion and optimum external laryngeal manipulation was performed by an assistant for the next attempt. After successful intubation, SAD was removed using a stabilizing rod and ETT was secured in position. Adequate oxygen saturation was ensured at all times during the procedure. Time required for successful insertion of SAD was defined as the time from removal of face mask to confirmation of adequate ventilation through SAD by capnography. Time required for successful tracheal intubation through SAD was defined as the time from disconnection of SAD from anaesthesia breathing circuit to confirmation of tracheal intubation by capnography. Two attempts were allowed for both SAD insertion and tracheal intubation in each group. If either SAD insertion or tracheal intubation was not achieved in two attempts, the case was noted as a failed tracheal intubation and tracheal intubation was done under direct laryngoscopy. Time taken for successful insertion of SAD and tracheal intubation was observed using a stop watch. At the end of the surgical procedure anaesthesia was discontinued, neuromuscular blockade was reversed with IV neostigmine 0.05 mg/kg and IV glycopyrrolate 0.01 mg/kg and the ETT removed after adequate clinical recovery. At the time of extubation, ETT was checked for blood staining as a sign of trauma. Postoperatively, after 2 hrs, the patients were interviewed to check for sore throat.

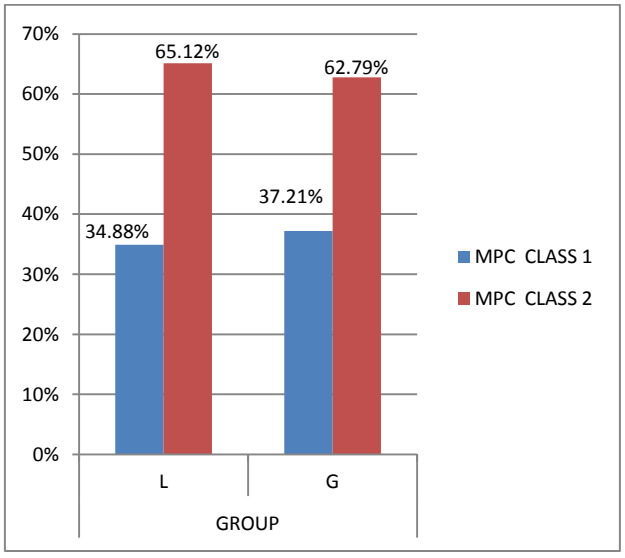
Results

The results obtained from both the groups of patients (L and G) were coded and entered in Excel. Chi-square test was used to analyse categorical data and *t* test was used to analyse continuous data. Categorical data are presented as number of patients and percentage and continuous data are presented as mean and standard deviation. IBM SPSS statistics 20.0 software was used to analyse the data. $P < 0.05$ was considered statistically significant.

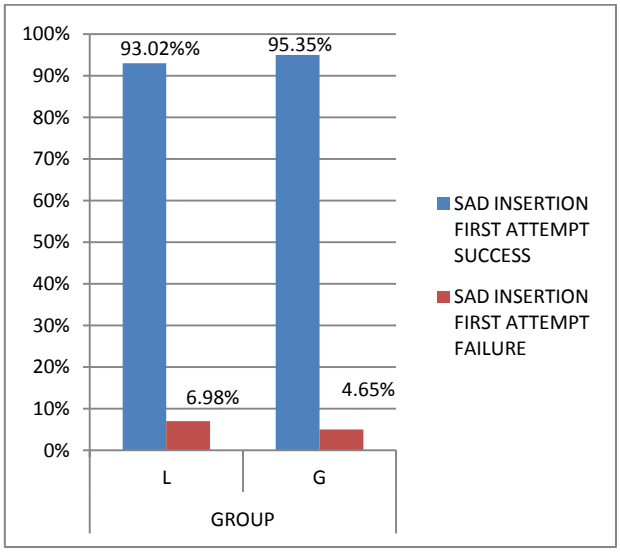
Patient parameters

PARAMETER	GROUP L (Mean ± SD)	GROUP G (Mean ± SD)	P VALUE
AGE (years)	46.14 ± 12.09	42.84 ± 11.49	0.198
WEIGHT (Kg)	60.86 ± 7.99	61.98 ± 9.36	0.554
MOUTH OPENING (cm)	4.95 ± 0.78	4.79 ± 0.71	0.338
NECK CIRCUMFERENCE (cm)	34.87 ± 2.03	34.74 ± 2.35	0.781
THYRO MENTAL DISTANCE(cm)	7.45 ± 0.59	7.44 ± 0.50	0.984

Mallampati classification



Success of SAD insertion in first attempt

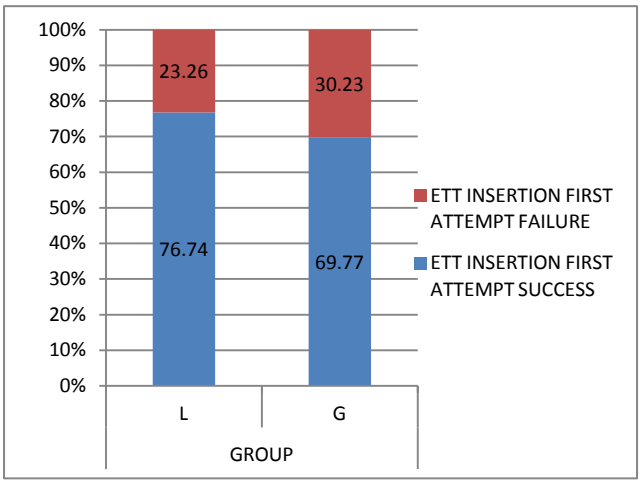


Patient parameters and mallampati classifications were statistically non significant (p>0.05)

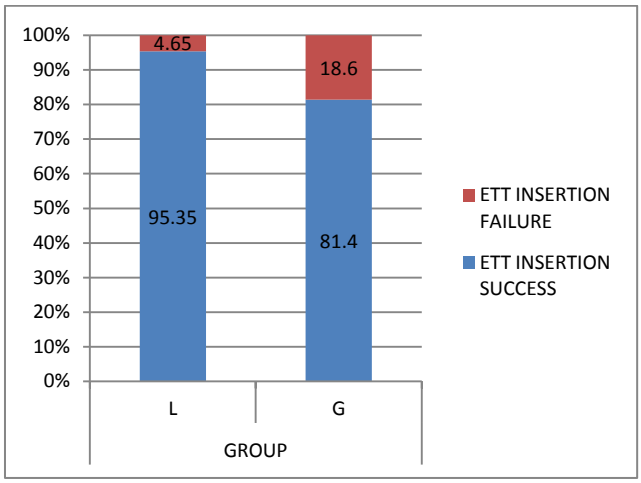
SAD insertion time

PARAMETER	GROUP L (Mean ± SD)	GROUP G (Mean ± SD)	P VALUE
SAD INSERTION TIME (sec)	31.72 ± 7.27	20.61 ± 4.46	<0.001
SAD INSERTION TIME WHEN FIRST ATTEMPT SUCCESSFUL (sec)	29.78 ± 1.59	9.69 ± 1.43	<0.001

Success of ETT insertion in first attempt



Success of ETT insertion



ETT Insertion Time

PARAMETER	GROUP L (Mean ± SD)	GROUP G (Mean ± SD)	P VALUE
ETT INSERTION TIME (sec)	23.95 ± 7.41	23.78 ± 5.47	0.909
ETT INSERTION TIME WHEN FIRST ATTEMPT SUCCESSFUL (sec)	20.84 ± 2.57	21.65 ± 1.42	0.129

Incidence of Sore Throat

SORE THROAT	GROUP L NUMBER (%)	GROUP G NUMBER (%)	P VALUE
PRESENT	5 (11.63)	7 (16.28)	0.534
ABSENT	38 (88.37)	13 (83.72)	

Blood staining of ETT

BLOOD STAINING	GROUP L NUMBER (%)	GROUP G NUMBER (%)	P VALUE
PRESENT	10 (23.26)	10 (23.26)	1
ABSENT	33 (76.74)	33 (76.74)	

Discussion

The common process of securing the airway involves endotracheal intubation after introduction of laryngoscope and visualization of vocal cords. But laryngoscopy inevitably involves distortion of normal anatomy to bring glottis into the line of sight. In addition, the normal tracheal tube is designed to allow its easy passage when the anatomy is distorted so and its curvature does not match with the contours of the relaxed anatomy of the upper airway.[10] But it is not always possible or desirable to distort the anatomy and laryngoscopy becomes difficult in those conditions. Difficult airway remains an important cause of mortality and morbidity in anaesthesia. Adverse outcomes associated with respiratory events are the single largest class of injury attributed directly to anaesthesia. So the primary skill that an anaesthesiologist must master is airway management.[1,57] Various airway adjuncts are available to help the anaesthesiologist to manage difficult airway. SADs are an important part of management of difficult airway as they allow for both rescue ventilation as well as act as a conduit for endotracheal intubation.[14]

Our study compared success rate of endotracheal intubation through ILMA and i-gel in 86 patients, randomly allotted in to two groups of 43 each [GROUP L (ILMA) and Group G (i-gel)]. Two groups were comparable in terms of age, gender, weight, ASA physical status and Mallampati classification.

Attempt at SAD insertion: In our study, both ILMA and i-gel could be positioned successfully in 100% cases. The SAD insertion was successful within single attempt in 93.02% (40/43) of patients in group L and in 95.35% (41/43) of patients in group G. This result was not statistically significant (p value =0.645). The result was similar to those observed in studies by Halwagi AE et al.[3] , Kapoor S et al.[10], Sastre JA et al.[1] and Bhandari G et al.[2]which showed a similar success rate in insertion of ILMA and i-gel. Overall time taken for insertion of SAD was 31.72 ± 7.27 sec in group Land20.61 ± 4.46 sec in group G (P value <0.001). The time taken for SAD insertion when first attempt at insertion was successful was 29.78 ± 1.59 sec in group L and 19.69 ± 1.43 sec in group G (P value <0.001). The time required for insertion of i-gel was thus significantly lesser than the time required for insertion of ILMA in both first and second attempts. The results were comparable to those observed by Halwagi AE et al.[3], Kapoor S et al.[10]and Bhandari G et al.[2] Study by Bhandari G et al.[2] observed overall insertion time of 30.69 sec in ILMA group and 20.92 sec in i-gel group (P< 0.001). The insertion time with successful first attempt of SAD insertion was 31.75sec in ILMA group and 20.52 sec in i-gel group (P<0.001)

Study by Halwagi AE et al.[3] observed an overall insertion time of 26 sec for i-gel and 36 sec for ILMA (P < 0.01). Insertion time when 1st attempt of SAD insertion was successful was 19 sec with i-gel and 29 sec with ILMA (P < 0.01).

Study by Kapoor S et al.[10] observed the overall insertion time to be 38.96 sec in ILMA group and 19.40 sec in i-gel group (P<0.0001). The insertion time during successful first attempt was 38.00 sec in ILMA group and 19.25 sec in i-gel group.

Attempt at ETT insertion: In our study, ETT insertion through SAD was successful in 95.35 % (41/43) of patients in group L and in 81.40 % (35/43) in group G (P value 0.044). The first attempt success rate of intubation was 76.74 % (33/43) in group L and 69.77% (30/43) in group G (P value 0.464). So the success rates of tracheal intubation through ILMA and i-gel do not have statistically significant difference when intubation was successful in the first attempt. However, the overall success rate of tracheal intubation through ILMA was higher than that through i-gel and the result was significant. Halwagi AE et al.[3]demonstrated successful tracheal intubation on the first attempt in 69% of patients with the i-gel and 74% of patient with the LMA Fastrach (P = 0.60). Overall intubation success rate was lower through the i-gel compared to the LMA Fastrach (73% vs. 91%, p < 0.01). The study by Sastre JA et al.[1]showed a higher success rate of intubations with the ILMA than i-gel (70% versus 40%; P=.013). In the study by Bhandari G et al.[2] ,the success rate in first attempt was 65% in i-gel group and 52.55% in ILMA group (p value 0.247) , while overall success rate was 77.5% in i-gel group as compared to 62.5% in ILMA group (P value 0.111). Though the success rate of blind intubation was found higher through i-gel in this study, results were not statistically significant. Study by Kapoor S et al.[10] showed first attempt success for blind tracheal intubation in 66% cases (33 patients) of i–gel group and in 74% cases (37 patients) of ILMA group (P value 0.352) . With the second attempt, blind tracheal intubation was successful in 82% cases (41 patients) of i-gel group and 96% cases (48 patients) of ILMA group (P value 0.025). The differences were not statistically significant.

Complications

In our study, post operative sore throat was present in 11.63 %[10] of subjects in the ILMA group and 16.28 %[9] in the i-gel group. Blood staining of the endotracheal tube was seen at the time of extubation in 23.26 % (10/43) of the subjects in both groups. The incidence of complications in both groups are

comparable and were similar to observations by Kapoor S et al.[10] and Bhandari G et al.[2].

Conclusions

In our study we compared the success rate of ILMA and i-gel as a conduit for blind endotracheal intubation.

From our study, we concluded that ILMA 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 ILMA for blind endotracheal intubation and an excellent choice for rescue ventilation.

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