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Research Paper

Comparison between the use of of LMA Proseal and I-gel as a conduit for fiberoptic bronchoscope guided Aintree Intubation Catheter insertion and subsequent endotracheal intubation

Medical Science

KEYWORDS : Aintree Intubation Catheter, LMA Proseal, I-gel

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ABSTRACT

Background: Aintree Intubation Catheter (AIC) is a bougie tube, designed for endotracheal intubation (ET) under fibreoptic guidance using LMA as conduit.

Methods: 98 patients were enrolled and randomized to two groups where LMA Proseal (group P) or I-gel (group I) was used as a conduit for AIC insertion. Ease of passage of AIC loaded over FOB through the LMA, time taken for endotracheal intubation, number of attempts, incidence of post operative sore throat, hoarseness, and airway trauma were recorded.

Results: Ease of insertion was significantly higher among Group I (P<0.05). Total time for successful ET intubation was comparable and there was no significant difference in incidence of oropharyngeal trauma in both the groups.

Conclusions: Time taken to achieve fibreoptic bronchoscope guided AIC insertion and endotracheal intubation is comparable with both LMA Proseal and I-gel. Ease of insertion of AIC is significantly better when I-gel is used as a conduit.

Introduction

ASA difficult airway algorithm recommends the use of fibrescope guided intubation through the LMA as part of alternative intubation approach in the non-emergency pathway.[1] Aintree intubation catheter (AIC) (Cook® Medical Inc., Bloomington, IN, USA) has been demonstrated to successfully enable fibreoptic-guided intubation through laryngeal mask airway (LMA). The AIC has a fixed length of 56 cm and 4.7 mm luminal diameter. It is intended for use in patients of all age groups. It can also be used to insufflate oxygen via a detachable Rapi-fit (Cook UK) connector.

Classic LMA was originally used for AIC insertion under fibreoptic guidance. Studies have compared LMA Proseal and classic LMA; I-gel and classic LMA as a conduit for FOB guided intubation using AIC and have concluded that the ease of insertion of AIC through the LMA Proseal and I-gel was better when compared to classic LMA.[2,3,4] Studies have not compared LMA Proseal and I-gel for insertion of AIC. We conducted this study to see if any of these are better when used as a conduit for FOB guided AIC insertion.

Methodology

After obtaining approval from Institutional Ethics Committee, 98 ASA PS 1 and 2 patients, aged between 18- 65 years, scheduled for elective surgeries under general anaesthesia requiring endotracheal intubation, were enrolled after obtaining written informed consent. Emergency surgeries requiring rapid sequence induction of anaesthesia, patients having cardio- respiratory pathology, patients with oral, maxillofacial or laryngeal pathology where LMA insertion was contraindicated or difficult were excluded. Patients were kept NPO at least 6 h for solids and 3 h for clear fluids and premedicated with oral diazepam 5- 7.5 mg on the night prior and morning of surgery.

Patients were randomized to 2 groups using computer generated random sequence into Group I (I-Gel used as a conduit for FOB guided AIC insertion) and Group P (LMA Proseal used as a conduit) and allocation concealment was ensured using sequentially numbered, opaque sealed envelopes. In the OR, after obtaining baseline vitals, patients were induced with IV fentanyl 2 mcg/ kg and Propofol 3mg/ kg. Ventilation was assisted with 2% isoflurane in 100% oxygen for 1-2 minutes. Adequate relaxation of jaw was ensured before insertion of LMA. If required, anaesthesia was deepened with additional bolus doses of propofol 1mg/ kg. Depending on the randomisation, either I-gel or LMA Proseal was inserted (steps of insertion depicted in figure 1)



Figure 1: **Steps of FOB guided AIC insertion and ET intubation using I gel as a conduit**

LMA of appropriate size was chosen based on patient's weight and the posterior aspect was lubricated with water soluble jelly prior to insertion. After insertion, proper position was confirmed by ensuring no/ minimal leak during ventilation, bilateral equal air entry on auscultation over the chest and a normal $ETCO_2$ trace. Patients were then paralysed with IV vecuronium 0.1 mg/kg and ventilated through LMA with 100% oxygen + isoflurane 2% to achieve a MAC of 1.0, till the train-of-four stimulus (TOF) of zero was recorded on neuromuscular monitor. Once TOF count of zero was obtained, the anaesthetic circuit was disconnected from LMA and Aintree Intubation Catheter loaded over 3.5 mm ED adult FOB (such that the distal 2 to 3 cm of the scope protruded beyond the AIC) was passed through the shaft of LMA. Best possible FOB view of laryngeal apparatus was graded with the tip of the FOB at LMA outlet. Under FOB guidance, AIC was inserted into trachea. Ease of passage of the AIC under FOB guidance through the LMA was graded. The FOB and LMA was removed ensuring the AIC in-place. After stabilising the AIC, an appropriate sized ET tube [size 7/7.5 in females and size 8/8.5 in males] which was shortened to a length of 26 cm was railroaded over the AIC. Any difficulty in passing the tube was overcome by partial withdrawal, anticlockwise rotation of the ET tube over the AIC and reinsertion. Successful confirmation of ET tube placement was done by auscultation of bilateral equal air entry over the chest and appearance of $ETCO_2$ trace.

Fibreoptic view of glottis was graded as follows: Grade I: Full view of cords, Grade II: Partial view of cords and arytenoids, part of epiglottis visible, Grade III: Only epiglottis visible, Grade IV: No laryngeal structures visible

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The time taken from disconnection of circuit from the LMA to successful confirmation of ET tube placement by $ETCO_2$ was taken as total time [T]. T1 - Time beginning from disconnection of circuit from the LMA, ending with removal of LMA after placement of the AIC and T2 –Time from beginning of insertion of ET tube over AIC to successful confirmation of placement of ET tube by $ETCO_2$ trace.

The ease of passage of the fibreoptic bronchoscope and AIC through the LMA, was assessed with a three point scoring system. 1- Easy passage, no or minimal resistance, 2- Moderate resistance to passage, and 3- Marked resistance to passage.

If grade 3 or 4 FOB view was obtained and FOB- AIC insertion was not possible or if ET tube passage was not possible in the first attempt, I-Gel/LMA Proseal was reinserted and one more attempt was tried. Maximum time allowed for each attempt was fixed as 180 seconds. It was decided that if the SPO_2 falls to <95% during any attempt, the procedure was paused, patient mask ventilated with 100% oxygen and isoflurane, anaesthesia deepened with propofol bolus (1mg/kg) and second attempt was tried. If unsuccessful during second attempt, the study was abandoned and endotracheal intubation was done using conventional laryngoscopy and anaesthesia continued as per the discretion of consultant anaesthesiologist posted for the case.

Power of the study was calculated using the time required for insertion of Aintree Intubation Catheter (T1) as the criteria. Average time required was taken as 60 seconds based on historical data and results of our pilot study. For significance, a difference in the time taken of 15 seconds between two groups was considered. For 90% power, we required to enroll a total of 49 patients in each group.

Results were analysed using the SPSS v16 statistical package for social sciences. Nonparametric data (Mallampati grade, ease of passage, number of attempts taken for insertion, blood stain on the LMA, blood stain on the ET tube, sore throat, and hoarseness of voice) were analysed using chi-square test and parametric data (age, BMI, time taken to achieve endotracheal intubation) were analysed using Independent samples t-test. A p value < 0.05 was considered as statistically significant.

Results

Both the groups were comparable with respect to distribution of age, weight, sex and BMI (Table 1). The distribution of patients in the four classes of Mallampati was comparable between the two groups. The time taken for achieving an effective airway was comparable in both the groups (Table 2). Ease of insertion of AIC–FOB through the LMA was grade 1 in 89.8% of group I patients and 71.4% of group P patients. The ease of insertion was significantly higher among Group I patients as compared to Group P patients (Table 3). In group I, we achieved a first attempt success of 95.9 % while in group P, it was 93.9 %. The fibreoptic glottic view obtained was comparable in both the groups (Table 4). Five patients in group P had sore throat postoperatively when compared to none of them in I- gel group. Statistically it was found to be significant. None of the patients had hoarseness of voice in the postoperative period in both groups of patients. We noticed blood stain in 8 (8.2%) patients on removing the LMA (3 in Group I and 5 in Group P). There was no significant difference in the incidence of oropharyngeal trauma (p value- 0.715, NS). Blood stain on endotracheal tube was observed in 1 patient from group I and 3 patients from group P (p- NS).

Table 1, 2, 3, 4 to be added about here

Discussion

In our study, ease of insertion of the AIC loaded over fibreoptic bronchoscope through the LMA was significantly higher among patients in whom I-gel was used as compared to LMA Proseal. The result was comparable to the study of de-Lloyd et al who also found the I-gel to be an easier passage to AIC insertion when compared to the Classic LMA in manikins.[5]

I-gel has a shorter and wider stem; the grille and the epiglottic bars are absent at the end of the airway tube. The tube section is firm and its natural curvature allows it to glide the leading edge against the hard palate into the pharynx. The epiglottic blocker reduces the incidence of epiglottic down folding and subsequent airway obstruction. The buccal cavity stabiliser is wide, and has a laterally flattened cross-section which helps in providing a good vertical stability upon insertion. This is advantageous over LMA with inflatable cuffs, as they have a tendency to get displaced upon cuff inflation because of forcing out of the distal end out of the upper oesophagus.[6]

We found that total time (T) required for successful endotracheal intubation over AIC was 57.61± 2.74 seconds with I-gel as compared to 60.71± 2.25 seconds with LMA Proseal (p= 0.384). T1 was important point of comparison in our study and we found that the time taken for insertion of AIC under FOB guidance using I-gel or Proseal LMA was comparable (33.84± 2.04 sec with I-gel Vs 38.04± 1.65 sec with LMA Proseal [p= 0.114]). The time taken was clinically in the acceptable range in both groups of patients and was in the similar range as mentioned in the studies of Hawkins et al (70-139 s with use of COPA),[7] Heard et al (93 s using LMA classic in manikin),[8]and Ravindran et al (111 s with classic LMA and 80 s with I-gel among juniors and 125 s with classic LMA and 73.5 s with I-gel among seniors).[4]

We achieved a first attempt success of 95.9% in group I and 93.9 % in group P. The success rate was comparable to previous studies of Heard et al (100%),[8] E.J. Blair et al (95%),[2] and Lauren C. Berkow et al (93%),[9] indicating that this method of intubation can be reliably practiced and can be an useful technique in the anaesthesiologist's armamentarium during management of a difficult intubation.

Five patients in group P (10.2%) had sore throat postoperatively when compared to none in group I (p= 0.05, S). Both I-gel and LMA Proseal when used as a conduit for AIC insertion will be in situ for a short duration and the morbidity that could occur due to cuff pressure could not possibly affect the incidence of sore throat. Increased incidence of sore throat in group P could be possibly contributed by trauma or manipulation during insertion.

None of the patients in both groups of the study complained of hoarseness of voice. Since AIC insertion is done under FOB guidance, the incidence of trauma to the glottic aperture appears unlikely and since advancement of ETT is done in the paralysed patient, trauma to the vocal apparatus is minimised.

Blood stain on the LMA indicating oro-pharyngeal trauma was found in 5 and 3 patients in Proseal LMA and I-gel group respectively. This could contribute to sore throat in the post operative period. However, none of the patients in I-gel group had any sore throat or hoarseness of voice. Since the overall incidence of trauma is low and comparable between the groups, we could not assume any significance to this finding.

Although the AIC has been shown to be an invaluable tool in managing a difficult intubation, it has been subject to some criticism. At 56 cm, the fixed length of AIC has been criticized by some as being too short to allow for reliable exchange of an LMA with ETT. In fact, due to the length being just adequate, there is a possibility of the AIC slipping out of the trachea during efforts of tracheal intubation over it. The FOB has a fixed length, and the AIC has been designed such that the distal 4 cm of the FOB is left free to allow forward and backward movement. For this reason, the length of the AIC cannot be increased. We overcame this problem by shortening the length of ET tube to 26 cm which is an acceptable practice. By doing this we could get additional length of the AIC for stabilisation during intubation over it.

Insertion of a supraglottic device as a conduit for fibreoptic-guided tracheal intubation can be a very useful option. It aids maintenance of a relatively secure airway during attempts at intubation, maintains oxygenation by intermittent ventilation and reduces the stress of the anaesthetic team when faced with difficult airway situation. It has been repeatedly described as a

"low skill technique" as it can be performed rapidly by relatively inexperienced anesthesiologists.[10,11,12]

Conclusions

Time taken for fibreoptic bronchoscope guided Aintree Intubation Catheter (AIC) insertion and subsequent endotracheal intubation is comparable when LMA Proseal or I-gel is used as a conduit. When compared to LMA Proseal, the ease of insertion of AIC is significantly better when I-gel is used as a conduit.

***Table 1*: Demographic data**

Parameter	Group I (n= 49)	Group P (n= 49)	p value
Age (years) Mean ± S.E.	38.84± 1.43	42.55±1.33	0.06* (NS)
Sex Male/ Female	22/ 27	23/ 26	0.839** (NS)
Weight (kg) Mean ± S.E.	59.57±1.15	62.12±1.27	0.139* (NS)
BMI(kg/m^2) Mean ± S.E.	24.70± 0.41	25.34±0.47	0.307* (NS)

* Independent samples T test; ** Chi-square test

NS-Not significant S.E. = Standard Error BMI= Body mass index

***Table 2*: Time taken to achieve endotracheal intubation**

Parameter	Group I (n= 49)	Group P (n= 49)	p value
T1 (seconds) Mean ± S.E.	33.84± 2.04	38.04 ±1.65	0.114* (NS)
T2 (seconds) Mean ± S.E.	23.77± 1.42	22.74± 1.17	0.579* (NS)
Total T (seconds) Mean ± S.E.	57.61±2.74	60.71± 2.25	0.384* (NS)

* Independent Samples T test NS- Not significant
S.E. Standard Error

***Table 3*: Ease of insertion**

Ease of insertion	Group I (n= 49)	Group P (n= 49)	p value
Grade 1- Easy passage with no or minimal resistance	44 (89.8%)	35 (71.4%)	0.021*(S)
Grade 2- Moderate resistance to passage	5 (10.2%)	14 (28.6%)	
Grade 3- Marked resistance to passage	0	0	
Total	49	49	

* Chi-Square test S-Significant

Table 4: Fibreoptic view of glottis

Fibreoptic view	Group I (n= 49)	Group P (n= 49)	p value
Grade 1	37 (75.5%)	36 (73.5%)	1.00* NS
Grade 2	12 (24.5%)	12 (24.5%)	
Grade 3	0 (0.0%)	1 (2.0%)	

*Fisher's Exact test NS- not significant

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