Manikin study comparing Low Skill Fiberoptic Intubation using Aintree Intubation Catheter via Classic LMA and I-gel

M Ravindran, R Baba, S West

Citation

M Ravindran, R Baba, S West. *Manikin study comparing Low Skill Fiberoptic Intubation using Aintree Intubation Catheter via Classic LMA and I-gel*. The Internet Journal of Anesthesiology. 2009 Volume 23 Number 1.

Abstract

Background. This study compared the use of Low Skill fiberoptic intubation using Aintree Intubation Catheter through Classic LMA and I-gel supraglottic airways in manikins.Methods. Forty participants, after being divided into senior and junior groups performed one intubation through both the supraglottic devices. We first compared the two supraglottic devices in each group and then compared the inset time, time to carinal view and time to first ventilation between the two groups.Results. The fiberoptic laryngeal view and the fiberoptic manipulation through the I-gel were significantly better than that obtained through the Classic LMA in both groups (p=<0.0001). There was also a significant difference in the time to carinal view and time to first ventilation in both groups with I-gel being quicker in both cases(p<.05). Then we compared the times to insert, carinal view and first ventilation through Classic LMA and I-gel between junior and senior groups. There was no statistically significant difference between the two groups in each of the above componentsConclusions. We conclude that Low Skill Fiberoptic Intubation using Aintree Intubation catheter is quicker and easier through I-gel than through Classic LMA in manikins.

INTRODUCTION

Low Skill Fiberoptic Intubation (LS-FOI) is a technique which allows fiberoptic endotrachael intubation using a supra-glottic airway device like classic LMA (cLMA, Intravent Ltd, Maidenhead, UK), as an adjunct[1]. LS-FOI forms an integral part of the Plan B or Secondary tracheal intubation plan of the Difficult Airway Society guidelines for an unanticipated difficult tracheal intubation scenario [2]. The use of LMA as an intubation conduit with fiberoptic guidance also forms an integral part of the American Society of Anaesthesiologists Practice Guidelines for Difficult Airways [3]. LS-FOI also forms an important part of the Competency based Specialist Registrar training of the Royal College of Anaesthetists of UK [4].

LS-FOI using Aintree Intubation Catheter (AIC, Cook UK, Letchworth, Herts, UK) has been described before using cLMA, cuffed oropharyngeal airway and Proseal LMAs [5, 6]. The I-gel (Intersurgical Ltd., Berkshire, UK) is a newer supraglottic airway, which has a non-inflatable cuff made of medical grade thermoplastic elastomer which mirrors the perilaryngeal anatomy. There are no clinical studies using LS-FOI with AIC through I-gel, but there is a case report which describes its use for difficult airway management [7].

We proposed to undertake a randomised crossover manikin study comparing the performance of the I-gel and cLMA for Low Skill Fiberoptic Intubation using the AIC.

METHODS

Local Research Ethics Committee approval was sought but the sub-committee decided that full ethics approval was unnecessary as the study was done on manikins. A written informed consent was obtained from all participants and they had the freedom to leave the study at any time. 40 anaesthetists and intensivists took part in the study and each of them had to do one intubation with cLMA and I-gel. Consultants, Specialist Registrars, Staff Grades and Senior House Officers took part in the study.

The manikin used in the study was the Laerdal Airway Trainer (Laerdal Ltd., Stavanger, Norway). In a previous study comparing airway training manikins for insertion of supraglottic devices, the Laerdal Airway Trainer was found to be one of the suitable manikins for a variety of supraglottic devices including I-gel [8]. The participants were given a demonstration of performing LS-FOI though cLMA and I-gel on the same manikin. Each participant then performed the LS-FOI using the two supraglottic airways on the manikin. The order in which the participants did the

intubations using the two supraglottic devices was randomised by flipping a coin.

Before the study the investigators found that the size 4 cLMA and I-gel provided the best possible and consistent view of the larynx and therefore this size was chosen for the study. Adequate lubrication was applied to the cLMA, I-gel, AIC, size 7 cuffed flexometallic endotracheal tube, fiberoptic scope and the oral cavity of the manikin. The cLMA partially deflated or the I-gel was inserted. The cLMA was then inflated according to the manufacturer's guidelines. Satisfactory positioning of the supraglottic device was confirmed by bag mask ventilation twice. A 4 mm flexible fiberoptic scope, mounted with an Aintree Intubation Catheter (AIC) was inserted down the shaft of the LMA or the I-gel until it passed the grilles of the cLMA or the end of the I-gel.

At this stage, the Laryngeal view was scored [9]:

- Grade 1 (vocal cords are seen in full, and without any obstruction of the view)
- Grade 2 (only a part of the vocal cords are seen – there may be partial obstruction by any part of the epiglottis or other tissues)
- Grade 3 (vocal cords not seen, but at least one other glottis structure is identifiable – e.g. any aspect of epiglottis, pyriform fossa, valecula)
- Grade 4 (vocal cords not seen and no identifiable glottis structure)

The FOB is then passed into the trachea until a view of the carina is obtained. The grade of FOB manipulation/positioning is scored:

- Grade 1 (Not difficult)
- Grade 2 (Moderately difficult)
- Grade 3 (Difficult)

Maintaining the view of the carina, the AIC is threaded over the FOB until its blue tip is seen through FOB. At this stage, FOB is gently pulled out of the cLMA/I-gel leaving the AIC in the situ in the trachea. In the case of the cLMA, it is deflated and then the cLMA/I-gel is removed leaving the AIC in the trachea. A size 7 flexometallic tube is then railroaded over the AIC and the trachea intubated. The AIC is then removed and the pilot balloon of the endotracheal tube is then inflated with the air. The end point of the study is when bag-valve ventilation shows bilateral chest expansion.

Recording made include:

- Time to insert supraglottic device: i.e. time from picking up device supraglottic to first ventilation of the manikin lungs
- Time to carinal view: i.e. time from picking up device supraglottic till the carina is seen
- Time to intubate: i.e. time from picking up device supraglottic till ventilation of the manikin lungs through the endotracheal tube
- Failure of LS-FOI: Defined as failure to intubate the trachea and ventilate within 180 seconds. After the study the participants were asked which supraglottic airway device they preferred for LS-FOI.

All data was analysed using Prism 5.0 for Windows (Graphpad Software, California). Statistical significance was quoted when $p<0.05$. Wilcoxon signed rank test (two tailed) was used to compare the two supraglottic devices in each group. The two groups were then compared using the unpaired student t test (two tailed). The ordinal data was compared using the chi-squared test for trends.

Figure 1

Figure 1. Low Skill Fiberoptic Intubation using I-gel as a conduit for passing Aintree Intubation Catheter over the Fiberoptic scope

RESULTS

In total forty anaesthetists and intensivists took part in our study which included twelve consultants, six staff grades, eleven specialist registrars and eleven senior house officers. They were divided into two groups i.e. senior and junior groups. Senior group had four years or more of anaesthetic experience and had done at least ten fiberoptic intubations. Each group had twenty participants. All participants had no experience in LS-FOI using any supraglottic airway as a conduit.

Differences between the fiberoptic laryngeal views via the two devices were analysed by the chi-squared test for trends. In both junior and senior groups p=<0.0001, suggesting a significant difference in the view between the two devices, with I-gel providing the better view.

The grade of fiberoptic manipulation via cLMA and I-gel between the two groups was also assessed by chi-squared test for trends. There was a statistically significant difference between the grade of manipulation (p<0.0001), with manipulation through the I-gel being easier of the two in both groups.

In the junior group, median time to insert cLMA was 10.5 s (95% CI: 9.8-12.13) and that for I-gel was 8 s (95% CI: 7.8-9.7). In the senior group, median time to insert cLMA was 10 s (95% CI: 9.5-11.8) and that for I-gel was 8 s (95% CI: 7.3-9.6). There was a significant difference in the insert times between cLMA and I-gel as assessed by Wilcoxon signed rank test p < 0.0001 in both groups.

Median time to carinal view was 80.5 s (95% CI: 70.3-92.74) with cLMA and 48 s (95% CI: 46.21-56.19) with I-gel in the junior group. Whilst, it was 80 s (95% CI: 68.9-98.28) with cLMA and 49 s (95% CI: 44.8-55.46) with I-gel in senior group. Wilcoxon signed rank test showed a statistically significant difference in the time to carinal view between cLMA and I-gel in both groups (p=0.0002 and p=0.0004)

The median time to first ventilation in the junior group was 111 s (95% CI: 97.37-126.4) with cLMA and 80 s (95% CI: 72.94-83.46) with I-gel and in the senior group it was 125 s (95% CI: 106.3-131.7) with cLMA and 73.5 s (95% CI: 73.14-97.5) with I-gel. There was a statistically significant difference in the median times to first ventilation between the cLMA and I-gel in both groups with p=0.0026 in junior group and p=0.0003 in senior group as assessed by Wilcoxon signed rank test.

We then compared the times to insert, times to carinal view and the times to first ventilation through cLMA and I-gel between junior and senior groups using the unpaired student t test (two tailed). There was no statistically significant difference between the two groups in each of the above components.

Figure 2

Table 1 Comparison of the times to insert supraglottic device, times to carinal view and the times to first ventilation through cLMA and I-gel between junior and senior groups. P values.

	Juniors cLMA Insert time	Juniors I-gel insert time	Juniors cLMA laryngeal view time	Juniors I-gel laryngeal view time	Juniors cLMA vent time	Juniors I-gel vent time
Seniors cLMA Insert time	p=0.6957	X	X	X	X	X
Seniors I-gel insert time	X	p=0.6771	X	X	X	X
Seniors cLMA laryngeal view time	X	X	p=0.9968	X	X	X
Seniors I-gel laryngeal view time	X	X	X	p=0.7647	X	X
Seniors cLMA vent time	X	X	X	X	p=0.4441	X
Seniors I-gel vent time	X	X	X	X	X	P=0.3901

There were two failures in junior group and three failures in the senior group and all of them occurred with the cLMA as the supraglottic device. All the failures were associated with difficulty in visualising the larynx and negotiating the grilles of the cLMA with the fiberoptic scope.

90% of the participants in the junior group preferred I-gel for LS-FOI and the remaining 10% had no preference. 80% of participants in the senior group preferred I-gel, 15% had no preference and 5% preferred cLMA for LS-FOI.

DISCUSSION

This study has shown that Low Skill Fiberoptic Intubation using Aintree Intubation Catheter is quicker and easier using an I-gel as compared cLMA in manikins. The Difficult Airway Society recommends use of LS-FOI as part of plan B of its unanticipated difficult airway scenario. The advantage of LS- FOI in anticipated and unanticipated difficult airway scenario is that it provides a relatively secured airway, maintains oxygenation and ventilation during attempts at

intubation and provides a conduit for fiberoptic intubation, which makes it a technique easy to learn and perform by relatively inexperienced anaesthetists.

LS-FOI using a normal or flexometallic endotracheal tube over a fiberoptic scope has its limitations. It is difficult to negotiate the epiglottic bar of the cLMA with the endotracheal tube and this technique also restricts the size of the endotracheal tube that can be passed through the cLMA [10]. The use of the Aintree Intubation Catheter helps solve all these problems to some extent. The Aintree Intubation Catheter has an internal diameter of 4.7mm and can accept a 4 mm fiberoptic bronchoscope.

I-gel has several advantages over classic LMA as a supraglottic airway device. It has a gastric channel, integral bite block and buccal cavity stabiliser. It has an epiglottic blocker which reduces the possibility of epiglottic down folding and airway obstruction. The gastric channel allows passage of a gastric tube to deflate the stomach, which is advantageous in positive pressure ventilation. The absence of grilles at the end of the airway tube and the larger lumen make I-gel an attractive supraglottic airway for LS-FOI [7].

The I-gel supraglottic airway has in cadaveric studies show to effectively conform to perilaryngel anatomy and consistently achieve proper positioning for supraglottic ventilation [11]. The I-gel has been shown to be a potentially useful device for resuscitation as it is easier to train non-anaesthetists how to correctly insert it [12]. I- gel insertion was also found to be rapid and easy by novices in both manikins and patients and compared favourably to other supraglottic airways [13]. I-gel has also been found to be a reliable supraglottic device both for spontaneous [14, 15] and pressure controlled ventilation [16].

There are no clinical studies using LS-FOI with AIC through I-gel, but there is a case report which describes its use for difficult airway management [7].

Blair and colleagues, in their study comparing cLMA vs Proseal LMA as airway conduits in manikins for LS-FOI using Aintree Intubating catheter, found no significant difference in the speed of intubation, ease of advancement or view of the cords [17]. In our study we found a statistically significant difference, with less intubation times, better laryngeal views and less need for fiberoptic manipulations with the I-gel compared to the cLMA. These finding could be because of the wider lumen, shorter length and wider cup without grilles of I-gel.

This study has shown that LS-FOI technique as the name suggests is a Low Skill Technique which requires less of a learning curve and can be used by less experienced colleagues in a difficult airway scenario. In our study we used both junior and senior physicians as participants. Our intention was to find out the differences in time to intubate amongst both these groups. As shown in the results although there was a small difference, it was not statistically different. These findings confirm Atherton and colleagues' findings that LS-FOI using AIC in cLMA has a short learning curve and has an important role in teaching fiberoptics techniques [18].

We allowed our participants to place the supraglottic device and to perform LS-FOI as we had found during our pilot study that the view of the larynx was quite consistent as we were using the same manikin and we also wanted to find out the total time of intubation from picking up the supraglottic device to intubation of the trachea with an endotracheal tube, as would happen in a real life scenario.

Our study has some drawbacks. This being a manikin study, it is may be difficult to extrapolate results to human beings. But we used the Lardel Airway Trainer which is a manikin that has been previously recommended for supraglottic devices [6].

Our study has thus shown that LS-FOI with AIC through the I gel is quicker and easier than through the cLMA in manikins. Most participants preferred the I-gel to cLMA for LS-FOI. These and the above mentioned design features make I-gel a possible superior alternative to cLMA for LS-FOI with AIC in the difficult airway scenario. There is a need for clinical studies using I-gel for Low skill fiberoptic intubations to validate this manikin study.

References

1. Higgs A, Clark E and Premraj K: Low-Skill fiberoptic intubation: use of the Aintree Catheter with the classic LMA. Anaesthesia; 2005; 60: 915-920.
2. Difficult Airway Society: Difficult Airway Society Guidelines for the Management of the Unanticipated Difficult Intubation. Anaesthesia; 2004; 59: 675-94.
3. Anonymous: Practice guidelines for management of difficult airway. An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology; 2003; 98: 1269-77.
4. http://www.ems.org.eg/syllibus_%20final_%20part.pdf [see page 19, section 7.2.7]
5. Cook T M, Silsby J, Simpson T P: Airway rescue in acute upper airway obstruction using a ProSeal Laryngeal mask airway and an Aintree Catheter: a review of the ProSeal Laryngeal mask airway in the management of the difficult airway. Anaesthesia; 2005; 60: 1129-36.

6. Hawkins M, O'Sullivan E, Charters P: Fiberoptic intubation using the cuffed oropharyngeal airway and Aintree intubation catheter. Anaesthesia; 1998; 53: 891-4.
7. Michalek P, Hodgkinson P, Donaldson W: Fiberoptic Intubation through an I-gel Supraglottic airway in two patients with predicted difficult airway and intellectual disability. Anesthesia Analgesia; 2008; 106: 1501-4.
8. Jackson K M and Cook T M: Evaluation of four airway training manikins as patient simulators for the insertion of eight types of supraglottic airway devices. Anaesthesia; 2007; 62, pages 388-93.
9. Danha R F, Thompson J L, Popat M T, Pandit J J: Comparison of fiberoptic-guided orotracheal intubation through classic and single-use laryngeal mask airways. Anaesthesia; 2005; 60, pages 184-88.
10. Pandit J J, MacLachlan K, Dravid R M, Popat M T: Comparison of times to achieve tracheal intubation with three techniques using the laryngeal or intubating laryngeal mask airway. Anaesthesia; 2002; 57: 128-132.
11. Levitan R M, Kinkle W C: Initial anatomic investigation of the I-gel airway: a novel supraglottic airway without inflatable cuff. Anaesthesia; 2005; 60: 1022-6.
12. Soar J: The I-gel supraglottic airway and resuscitation – some initial thoughts. Resuscitation; 2007; 74: 197.
13. Wharton N M, Gibbison B, Gabbott D A et al: I-gel insertion by novices in manikins and patients. Anaesthesia; 2008; 63, pages 991-995.
14. Bamgbade O A, Macnab W R, Khalaf W M: Evaluation of the I-gel airway in 300 patients. Eur J Anaesthesiol; 2008; 25: 865-6.
15. Gatward J J, Cook T M, Seller C et al: Evaluation of the size 4 I-gel trade mark airway in one hundred non-paralysed patients. Anaesthesia; 2008; 63: 1124-30.
16. Uppal V, Fletcher G, Kinsella J: Comparison of the I-gel with the cuffed tracheal tube during pressure-controlled ventilation. Br J Anaesth; 2009; 102: 264-8.
17. Blair E J, Mihai R, Cook T M: Tracheal intubation via the Classic and Proseal laryngeal mask airways: a manikin study using the Aintree Intubating Catheter. Anaesthesia; 2007; 62: 385-387.
18. Atherton D P L, O'Sullivan E, Lowe D and Charters P: A ventilation-exchange bougie for fiberoptic intubations with the laryngeal mask airway. Anaesthesia; 1996; 51: 1123-1126.

Author Information

M.N. Ravindran
Department of Anaesthetics, Mayday University Hospital, Croydon, United Kingdom. CR77YE.

R. Baba
Department of Anaesthetics, Mayday University Hospital, Croydon, United Kingdom. CR77YE.

S. West
Department of Anaesthetics, Mayday University Hospital, Croydon, United Kingdom. CR77YE.