

Comparison of the air-Q ILA™ and the LMA-Fastrach™ in airway management during general anaesthesia

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Abstract

One hundred and sixty patients aged between 20-60 years with ASA physical status I-II, undergoing elective surgery under general anaesthesia, were enrolled into this prospective, randomised, double-blinded study to compare the success rate of tracheal intubation between the air-Q™ intubating laryngeal airway (ILA) and the laryngeal mask airway (LMA)-Fastrach™ (80 patients in each group). The degree of mouth opening, occurrence of coughing, laryngospasm, ease of insertion, adequacy of ventilation, and number of attempts were recorded during the insertion of the air-Q™ ILA and the LMA-Fastrach™. Tracheal intubation via the supraglottic airway devices was then performed, and cricoid manipulation, ease of insertion and number of attempts, were noted. Postoperatively, the degree to which patients had a sore throat using visual analogue scale (VAS), hoarseness of voice and blood on the air-Q™ ILA and the LMA-Fastrach™ were recorded. In terms of ease of insertion, there was no statistically significant difference between the insertion of the air-Q™ ILA and the LMA-Fastrach™. However, in terms of ease of tracheal intubation, the LMA-Fastrach™ group was superior (p-value = 0.001) in terms of external cricoid manipulation requirement, ease of intubation, and the number of attempts (p-value = 0.009). The success of blind intubation, with up to three attempts, was 77 (97.47%) and 60 (75%) patients, in the LMA-Fastrach™ and air-Q™ ILA groups, respectively. In conclusion, there was no statistical difference between the air-Q™ ILA and the LMA-Fastrach™ in terms of ease of insertion, incidence of adverse response, and adequacy of ventilation. However, tracheal intubation was superior using the LMA-Fastrach™, rather than the air-Q™ ILA.

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Introduction

Significant morbidity and mortality in anaesthesia have been shown to result from inadequate knowledge and experience in airway management. Adverse outcomes that are associated with respiratory events constituted the single largest class of injury in the American Society of Anesthesiology Closed Claims Study.¹ Proper airway management provided adequate ventilation and protection of the lungs against aspiration. The emphasis that is placed on the airway management stems from the risk of acute hypoxia due to airway mishap, which can rapidly lead to death or permanent neurological disability.

Tracheal intubation is considered to be the “gold standard” for securing the airway, because it allows proper establishment of ventilation, as well as offering protection against pulmonary aspiration. Considerable training is required in order for a healthcare provider to be skillful in laryngoscopy and endotracheal intubation. Also, efficiency needs to be maintained through constant practice. The

problem of failed or difficult intubation has always been of great concern. This is compounded by the fact that incidents relating to potentially difficult airways are not easily identified, nor predicted.

Recently, there has been rapid development and advancement in airway management. The result is that an increased number of equipment for airway management has become available. The classical laryngeal mask airway (LMA), first described by Brain in 1985, is a supraglottic airway device which has simplified airway management.²⁻⁴ Soon afterwards, improved versions with advanced designs were made available with enhanced safety and effectiveness. Extensive training and skill are not required when utilising these supraglottic airway devices. This made their usage more widespread, including use by allied healthcare providers with limited expertise in suburban and rural areas.⁵⁻⁶ A basic limitation of the LMA is that it lacks reliability in protecting the lungs from regurgitated stomach content, even though it may appear to act as a barrier at

the level of the upper-oesophageal sphincter when correctly positioned.⁷

The LMA-Fastrach™ is specially designed for tracheal intubation. There have been many reports of eventual successful intubation, both in cases of anticipated and unanticipated difficult airways.⁸⁻¹⁴ Reported success rates of tracheal intubation using the LMA-Fastrach™ have varied between 89.5-100%.¹⁵⁻¹⁸ Intubation using the intubating laryngeal mask airway has been associated with lesser adverse cardiovascular responses, compared to conventional intubation with direct laryngoscopy. Fewer incidents of injury to teeth and lips were reported as the laryngoscope was not required.¹⁹

A relatively new supraglottic airway device, the air-Q™ ILA, is also designed for tracheal intubation. Successful intubations have been reported using it, even in patients with anticipated difficult airways.²⁰⁻²¹ This new method has been deemed to be equally effective for airway management, has additional features for improved performance, and may be equally cost-effective.

This study was conducted to compare the success rate of tracheal intubation between the air-Q™ ILA and the LMA-Fastrach™ in patients undergoing elective surgery under general anaesthesia. In addition, patients' response to the insertion of the supraglottic airway devices, ease of insertion, and adequacy of ventilation, frequency of post-extubation sore throats, hoarseness of voice, and the presence of blood on the supraglottic airway devices as markers for trauma to the pharyngeal and laryngeal structures, were also investigated.

Method

This prospective, randomised clinical trial was conducted following the approval of the Dissertation Committee, Department of Anaesthesiology and Intensive Care, Universiti Kebangsaan Malaysia Medical Center (UKMMC) and the Universiti Kebangsaan Malaysia research and ethics committee (project code: FF-204-2009). All patients gave written informed consent. One hundred and sixty patients, aged between 20-60 years with ASA physical status I-II, were recruited for this study, and were divided randomly into one group using the air-Q™ ILA, while the other group used the LMA-Fastrach™. The use of a particular device, the air-Q™ ILA or the LMA-Fastrach™, was determined by serially numbered, opaque, sealed envelopes for the purpose of randomisation and concealed allocation. As the LMA-Fastrach™ is a safe and reliable method, used in UKMMC when tracheal intubation is difficult, and when ventilation using other supraglottic devices fails, it was selected to be used in the control group. As the air-Q™ ILA is a new design, it was assigned to the experimental group. Exclusion criteria included anticipated difficult airways (Mallampati scores > 3, limited mouth opening with inter-incisor gap < 2 cm, and difficult or limited neck extension), morbid

obesity, pregnant women, respiratory tract infections, patients at risk of regurgitating, and airway surgeries.

Midazolam 7.5 mg was given to the patients the night before surgery, and orally as pre-medication prior to transfer to the operating theatre complex. In the operating theatres, monitoring was established. This included an electrocardiograph, pulse oximetry (SpO₂), capnography (EtCO₂), non-invasive blood pressure, and minimum alveolar concentration of inhalational anaesthetic agents.

In the supine position, the patient's head and neck were placed in a neutral position. The patient was pre-oxygenated for five minutes, or until end-tidal oxygen percentage (EtO₂) was above 80%. Drugs given for induction included fentanyl 1-2 µg/kg, propofol, 2-4 mg/kg and rocuronium, 0.6 mg/kg. Manually assisted ventilation with sevoflurane 3-4% was carried out to allow time for the muscle relaxant to take effect, and for the patients to be adequately anaesthetised. Before insertion of the air-Q™ ILA or the LMA-Fastrach™ was attempted, a relaxed jaw, absent eyelash reflex, apnoea and central position of pupils, were established.

In women, a size 3 air-Q™ ILA or size 3.5 LMA-Fastrach™ were used. In men, a size 4 air-Q™ ILA or size 4.5 LMA-Fastrach™ were used. Lubrication of the front and back of the air-Q™ ILA or the LMA-Fastrach™ and a jaw lift were carried out to facilitate its insertion. After insertion, the cuff was inflated, and its pressure adjusted to between 60-70 cmH₂O, using a hand-held cuff-inflator manometer. Proper placement was confirmed by listening for signs of a leak, observing rising of the chest, and noting the presence of a normal capnograph tracing under manually assisted ventilation. Adjustments were allowed to be made if ventilation was unsatisfactory. Changing to a larger- or smaller-sized device was also permitted to ensure proper placement of the devices in the supraglottic region. Insertion of the supraglottic airway devices was abandoned if the number of failed attempts exceeded three times, and was considered to have failed if satisfactory ventilation was not achieved. Ease of insertion was recorded, as well as the number of attempts and adequacy of ventilation.

Subsequently, blind intubation via the supraglottic device was performed. The patients were kept anaesthetised with an appropriate concentration of sevoflurane in 100% oxygen. A size 7 and size 7.5 conventional oral endotracheal tube (ETT) were used for intubation via the air-Q™ ILA in the women and the men respectively. Size 7 and size 7.5 silicone ETTs were used for intubation using the LMA-Fastrach™ in the women and the men respectively. The ETT was well lubricated to ensure smooth passage during intubation. For each failed intubation that was experienced, adjustments were allowed to be made to the air-Q™ ILA or the LMA-Fastrach™, if necessary. Ease of intubation and number of attempts were recorded. The ETT was left in situ using the stylet that was provided, while the supraglottic airway device was removed.

The insertion of the air-Q™ ILA and the LMA-Fastrach™, and subsequently tracheal intubation, was performed by a single operator with experience of more than 10 insertions of each device. The outcomes of the intubation were assessed by a blinded independent assessor. The initial procedure was carried out in the absence of the assessor, and after intubation the airway device was draped to conceal the identity of the device used from the assessor. Based on capnograph tracing, chest-wall movements and auscultation of the lungs, the assessor confirmed or reputed successful intubation.

For the insertion of the air-Q™ ILA and the LMA-Fastrach™, mouth opening, coughing, laryngospasm, movement, adequacy of ventilation, number of attempts performed, and outcome of successful insertion were recorded. Ease of passage was graded as “easy”, “moderate” or “difficult”. Tracheal intubation was only attempted after successful insertion of the supraglottic airway device, and any requirements in respect of cricoid manipulation, ease of insertion, number of attempts performed, and outcome of successful insertion were recorded. Ease of tube passage was similarly graded as “easy”, “moderate” or “difficult”. The occurrence of a post-extubation sore throat was graded as “nil”, “mild”, “moderate” and “severe”, hoarseness of voice was graded as “nil”, “mild to moderate” and “severe”, and the presence of blood on the supraglottic device was also recorded.

The sample size calculation was carried out using the computer software, PS Power and Sample Size Calculations®, Version 3.0. The following values were used for the calculation: $\alpha = 0.05$, power = 0.80, $P_0 = 0.73$, $P_1 = 0.905$. This was based on a previous study that compared two tracheal intubation techniques in patients with cervical spine disorders.¹² Statistical Package for Social Sciences® Version 19 was used for analysis. Student’s t-test was used to analyse the difference in the age and weight of patients in both groups. Pearson’s chi-square was used to analyse the difference in the ethnicity of the patients, mouth opening, coughing, movement and number of attempts during insertion of the air-Q™ ILA and the LMA-Fastrach™, cricoid manipulation, ease of insertion, number of attempts and successful tracheal intubation, and post-extubation sore throats, hoarseness of voice, and blood on the supraglottic airway devices. Fisher’s exact test was used to analyse the ease of insertion, adequacy of ventilation and successful insertion of the supraglottic airway devices. The Cochran Mantel-Haenszel Statistics was used in order to compare ordinal variables, namely ease of passage, a sore throat, hoarseness of voice. A p-value of less than 0.05 was taken to be statistically significant.

Results

Table I shows the demographic data of the patients in the air-Q™ ILA and LMA-Fastrach™ groups. No statistically

significant differences were seen between the two groups with respect to age, weight and ethnicity. There were 80 patients in the air-Q™ ILA group, and the same number of patients in the LMA-Fastrach™ group.

Table I: Demographic data of patients in the air-Q™ ILA and LMA-Fastrach™ groups

Demographic data	air-Q™ ILA n = 80	LMA-Fastrach™ n = 80
Age (years)	40.94 ± 12.06	38.71 ± 11.54
Weight (kg)	64.76 ± 12.27	64.11 ± 12.78
Sex (male/female)	40/40	40/40
Ethnic group		
Malay	41 (51.25)	53 (66.25)
Chinese	24 (30)	17 (21.25)
Indian	11 (13.75)	5 (6.25)
Others	4 (5)	5 (6.25)

Values are expressed as mean ± standard deviation or n (%).

Table II shows the results of the insertion of the supraglottic airway devices, tracheal intubation, and post-extubation outcome. It was possible to insert the supraglottic device in all 160 study patients, except in one male patient in the LMA-Fastrach™ group. The insertion was considered to be a failure as satisfactory ventilation was not achievable, evidenced by the absence of a rising chest, breathing sounds by auscultation and capnograph tracing under manually assisted ventilation. Hence, subsequent tracheal intubation could not be performed, and he was removed from this study and excluded from the analysis of tracheal intubation. This left 79 patients in the LMA-Fastrach™ group. Overall, there was no statistically significant difference in the comparison of the insertion of the air-Q™ ILA with that of the LMA-Fastrach™ (p-value > 0.05). There was no statistically significant difference between the groups with regard to adequacy of mouth opening, ease of passage into the oral pharynx, frequency of adverse responses such as coughing, laryngospasm and reflex movement, and the number of attempts required for success. Insertion of the supraglottic airway devices in four patients in the air-Q™ ILA group was associated with a moderate degree of difficulty due to their small mouths, inadequate lubrication and incorrect positioning. Repeated attempts were required.

Blind tracheal intubation using the air-Q™ ILA was possible in 60 cases (75%) within three attempts. Intubation was successful at the first attempt in 51 cases (63.8%), at the second attempt in 6 cases (7.5%), and at the third attempt in 3 cases (3.8%). The tracheas of 20 patients (25.0%) were not successfully intubated within the three attempts.

Blind tracheal intubation using the LMA-Fastrach™ through the intubating laryngeal mask

was possible in 77 patients (97.4%) within three attempts. Intubation was successful at the first attempt in 65 patients (82.3%), at the second attempt in 7 patients (8.9%), and at the third attempt in five patients (6.3%). The tracheas of two patients (2.5%) were not successfully intubated within three attempts. Compared to the LMA-Fastrach™, intubation via the air-Q™ ILA required more attempts at external cricoid manipulation to facilitate its insertion (p -value = 0.009). The difference in the frequency of successful tracheal intubation with various degrees of difficulty was statistically significant (p -value = 0.001). There was also a statistically significant difference in terms of the number of attempts required to achieve successful intubation between the two groups (p -value = 0.006). We postulate that, in view of better manoeuvrability for alignment, easier ETT passage, and softer and more flexible supraglottic cuff, the LMA-Fastrach™ had a higher overall successful tracheal intubation rate compared to the air-Q™ ILA (p -value = 0.001), as shown in Table II.

The frequency of occurrence of blood on the supraglottic airway devices showed a statistically significant difference (p -value <0.001) between the two groups. However, the frequency of occurrence of a sore throat and hoarseness of voice between the groups did not show any statistically significant difference (p -value > 0.05).

One patient sustained a moderate degree of morbidity after a failed tracheal intubation attempt using the air-Q™ ILA, although she had full mouth opening and insertion of the air-Q™ ILA was fairly easy, and required only a single attempt. Subsequently, in the immediate postoperative period, she complained of a moderately sore throat. Blood was present on the device at the time of its removal. Analgesics were given in the post-anaesthetic care unit, and prescribed in the ward for treatment of the surgical wound and the sore throat. She was sent home the next day with a supply of analgesics. From a telephonic conversation, it was noted that her sore throat, which was aggravated by swallowing and phonation, worsened over the next few days. As she lived a long distance from the hospital, she was advised to visit her nearest doctor, who treated her with additional analgesics and antibiotics. Her condition began to improve after approximately a week. No specific cause was identified for this isolated incident.

Discussion

There was no statistical difference between the air-Q™ ILA and the LMA-Fastrach™ in terms of ease of insertion, incidence of adverse response, and adequacy of ventilation. The flexibility of the plastic airway tube of the air-Q™ ILA allowed it to be slightly compressed as it slid past the teeth, even when there was no full mouth opening. This constituted an improvement in design. The airway tube of the LMA-Fastrach™ is made of rigid metal, and often it was difficult to pass the device across the inter-incisor gap in patients with

Table II: Insertion of the air-Q™ ILA and the LMA-Fastrach™, tracheal intubation, and post-extubation outcome in both groups

Category	air-Q™ ILA n = 80	LMA-Fastrach™ n = 80
Supraglottic device insertion		
Mouth opening		
Full/partial/nil	66/14/0	71/9/0
Coughing		
Nil/mild/severe	76/4/0	74/6/0
Laryngospasm		
Nil/mild/severe	80/0/0	80/0/0
Movement		
Nil/mild/vigorous	70/10/0	74/6/0
Ease of passage		
Easy/moderate/difficult	76/4/0	80/0/0
Adequacy of ventilation		
Able/unable	80/0	79/1
Number of attempts		
1	77 (96.25)	72 (90)
2	2 (2.5)	5 (6.25)
3	1 (1.25)	2 (2.5)
Failure after third attempt	0 (0)	1 (1.25)
Successful insertion		
Yes/no	80/0	79/1
Tracheal intubation		
Croicoid manipulation^a		
Not required/required	41/39	65/14
Ease of passage^a		
Easy/moderate/difficult	60/0/20	74/3/2
Number of attempts^a		
1	51 (63.75)	65 (82.28)
2	6 (7.5)	7 (8.86)
3	3 (3.75)	5 (6.33)
Failure after third attempt	20 (25)	2 (2.53)
Successful intubation^a		
Yes/no	60/20	77/2
Post-extubation outcome		
A sore throat		
Nil/mild/moderate/severe	39/33/6/2	43/31/5/1
Blood on the device^a		
Absent/present	50/30	75/5

Values are expressed as n (%).

a = p -value < 0.05

inadequate mouth openings. The ease of insertion of both the air-Q™ ILA and the LMA-Fastrach™ did not correlate with the required number of attempts to achieve success. It is possible that the degree of mouth opening played a very important role in determining the number of attempts, the success rate pertaining to the insertion of the supraglottic airway devices, and also the frequency of post-extubation

sore throats, hoarseness of voice and presence of blood on the devices.

Our success in inserting the air-Q™ ILA, and the subsequent blind tracheal intubation, is comparable to that achieved in a pilot study by Barker et al using the air-Q™ ILA in clinical use. They reported that the air-Q™ ILA was successfully placed in all patients (100%), and the first attempt was successful in 88% of patients. The trachea was successfully intubated in 74%, and the first attempt was successful in 58% of patients.²¹ Barker et al noted the relatively low success rate for blind tracheal intubation using the air-Q™ ILA, and attributed it to poor structural design, the lack of a specially designed accompanying endotracheal tube, and the need for adequate experience with its use.²¹ We postulate that a very long learning curve is required to achieve improved results, especially with respect to success with blind endotracheal intubation.

However, this study showed a higher successful tracheal intubation rate, of 97.47%, using the LMA-Fastrach™. This result is consistent with other studies which varied between 89.5-100%.¹⁵⁻¹⁸ Ease of tracheal intubation using the LMA-Fastrach™ was significantly superior to using the air-Q™ ILA in terms of cricoid manipulation requirement, ease of passage, number of attempts required, and eventual success rate.

The provision of a handle on the LMA-Fastrach™, together with its rigid metal body, allowed manoeuvrability when aligning its lumen with the tracheal inlet. In the case of the air-Q™ ILA, cricoid manipulation was the only means to facilitate alignment for tracheal intubation. The silicone tip and flexibility of the specially designed ETT, which is packaged together with the LMA-Fastrach™, may have even allowed successful tracheal intubation, even if the device and tracheal inlet were slightly malaligned. With adequate lubrication, these features allowed much easier passage of the tube through the LMA-Fastrach™. Due to its hard and rigid polyvinyl chloride (PVC) body, considerable friction was experienced during the passage of the conventional ETT through the air-Q™ ILA, even with adequate lubrication. We postulate that the rigid tip of the ETT may have often pushed against the anterior portion of the glottis and vocal cords, which led to an increased incidence of failed intubation and resultant trauma.²²⁻²⁴

It was also noted that proper positioning of the supraglottic airway devices largely influenced successful tracheal intubation. The size of the supraglottic airway devices played a role in this as success was achieved in patients with smaller builds, when another attempt, with a smaller-sized supraglottic airway device, was made. Another relatively important factor could be the stiffness of the cuff of the supraglottic airway devices that ensured their ability to fit properly in the hypopharynx. The cuff of the air-Q™ ILA is more rigid than the silicone cuff of the LMA-Fastrach™. Therefore, a properly positioned cuff was encountered more

frequently when using the air-Q™ ILA, than when using the LMA-Fastrach™.

The most probable reason for failure of ventilation in one of the patients is that he or she had a somewhat irregular or abnormal laryngeal structure that prevented proper positioning of the LMA-Fastrach™ in the supraglottic region. This would explain why attempted ventilation failed. Although up to three attempts were made, the insertion of the LMA-Fastrach™ was carried out with care and minimal force. Due to the ventilation failure, insertion of the LMA-Fastrach™, and subsequent tracheal intubation, was abandoned. Intubation under direct laryngoscopy was performed. The patient did not complain of a sore throat post-extubation. Also, there was no evidence of hoarseness of voice nor blood on the device.

The incidence of sore throats did not correlate with the number of attempts made to insert the supraglottic airway devices or tracheal intubation. However, the presence of blood on the air-Q™ ILA was seen in significantly more patients than it was on the LMA-Fastrach™ (p-value <0.001). Seventy-five per cent of patients who experienced blood on the devices complained of a sore throat. Approximately, two thirds of patients who complained of having a sore throat were women. The reason for this is not apparent from data relating to this study. A few postulated reasons are possible for these post-extubation adverse effects. Partial mouth opening may have had affected both the air-Q™ ILA and the LMA-Fastrach™ insertion as additional force and manipulation were required to place the devices past the teeth, through the oral cavity, and into the larynx. However, as mentioned above, patients with partial mouth openings did not show any statistically significant difference in post-extubation outcome. The cuff of the air-Q™ ILA is made of harder and stiffer plastic material, when compared to the softer silicone cuff of the LMA-Fastrach™. Therefore, this contributed to trauma of the soft tissues in the pharynx and larynx. The hard PVC ETT, used together with the air-Q™ ILA, may have impacted on the laryngeal structures as it exited the supraglottic airway device, leading to trauma. As mentioned above, even with adequate lubrication, considerable friction was noted during its passage through the air-Q™ ILA. Therefore, extra force was required, and this may have contributed further to injury. On the other hand, the silicone-tipped ETT, used together with the LMA-Fastrach™, would have caused lesser impact on the laryngeal structures. In addition, excess external cricoid manipulation would have aggravated air-Q™ ILA use.

A limitation of this study was that the patient population was selected from healthy patients without difficult airways and the risk of aspiration, and who underwent elective general anaesthesia. This comparative study between the air-Q™ ILA and the LMA-Fastrach™ did not have significant power to establish the less common complications that are associated with the use of supraglottic devices.

This study showed that there was no statistical difference between the air-Q™ ILA and the LMA-Fastrach™ in terms of ease of insertion, incidence of adverse response, and adequacy of ventilation. However, tracheal intubation was superior using the LMA-Fastrach™, compared with the air-Q™ ILA.

References

1. Caplan RA, Posner KL, Ward RJ, Cheney FW. Adverse respiratory events in anesthesia: a closed claims analysis. *Anesthesiology*. 1990;72(5):828-833.
2. Brain AJJ. Three cases of difficult intubation overcome by the laryngeal mask airway. *Anaesthesia*. 1985;40(4):353-355.
3. Parmet JL, Colonna-Romano P, Horrow JC, et al. The laryngeal mask airway reliably provides rescue ventilation in cases of unanticipated difficult tracheal intubation along with difficult mask ventilation. *Anesth Analg*. 1998;87(3):661-665.
4. Hagberg CA, Jensen FS, Genzwuerker HV, et al. A multicenter study of the Ambu laryngeal mask in nonparalyzed, anesthetized patients. *Anesth Analg*. 2005;101(6):1862-1866.
5. Bickenbach J, Schaelte G, Beckers S, et al. The intuitive use of laryngeal airway devices by lay responders. *Critical Care*. 2004;8:291.
6. Young B. The intubating laryngeal-mask airway may be an ideal device for airway control in the rural trauma patient. *Am J Emerg Med*. 2003;21(1):80-85.
7. Keller C, Brimacombe J, Bittersohl J, et al. Aspiration and the laryngeal mask airway: three cases and a review of the literature. *Br J Anaesth*. 2004;93(4):579-582.
8. Joo H, Rose K. Fastrach: a new intubating laryngeal mask airway: successful use in patients with difficult airways. *Can J Anaesth*. 1998;45(3):253-256.
9. Shung J, Avidan MS, Ing R, et al. Awake intubation of the difficult airway with the intubating laryngeal mask airway. *Anaesthesia*. 1998;53(7):645-649.
10. Parr MJA, Gregory M, Baskett PJF. The intubating laryngeal mask. Use in failed and difficult intubation. *Anaesthesia*. 1998;53(4):343-348.
11. Nakazawa K, Tanaka N, Ishikawa S, et al. Using the intubating laryngeal mask airway (LMA-Fastrach) for blind endotracheal intubation in patients undergoing cervical spine operations. *Anesth Analg*. 1999;89(5):1319-1321.
12. Yoshitaka I, Kazunori K, Akio S. A comparison of two tracheal intubation techniques with Trachlight™ and Fastrach™ in patients with cervical spine disorders. *Anesth Analg*. 2002;94(3):667-671.
13. Ferson DZ, Rosenblatt WH, Johansen MJ, et al. Use of the intubating LMA-Fastrach™ in 254 patients with difficult-to-manage airways. *Anesthesiology*. 2001;95(5):1175-1181.
14. Baskett PJ, Parr MJ, Nolan JP. The intubating laryngeal mask. Results of a multicentre trial with experience of 500 cases. *Anaesthesia*. 1998;53(12):1174-1179.
15. Steel A. The intubating laryngeal mask airway. *Emerg Med J*. 2005;22(1):47-49.
16. Kapila A, Addy EV, Verghese C, Brain AJJ. The intubating laryngeal mask airway: an initial assessment of performance. *Br J Anaesth*. 1997;79(6):710-713.
17. Brain AJJ, Verghese C, Addy EV, et al. The intubating laryngeal mask. II: a preliminary clinical report of a new means of intubating the trachea. *Br J Anaesth*. 1997;79(6):704-709.
18. Agrò F, Brimacombe J, Carassiti M, et al. The intubating laryngeal mask: clinical appraisal of ventilation and blind tracheal intubation in 110 patients. *Anaesthesia*. 1998;53(11):1084-1090.

19. Siddiqui NT, Khan FH. Haemodynamic response to tracheal intubation via intubating laryngeal mask airway versus direct laryngoscopic tracheal intubation. *J Pak Med Assoc*. 2007;57(1):11-14.
20. Jagannathan N, Roth AG, Sohn LE, et al. The new air-Q™ intubating laryngeal airway for tracheal intubation in children with anticipated difficult airway: a case series. *Paediatr Anaesth*. 2009;19(6):618-622.
21. Barker EJ, Valkenburg M, Galvin EM. Pilot study of the air-Q Intubating Laryngeal Airway in clinical use. Free Library [homepage on the Internet]. 2009. Available from: <http://www.thefreelibrary.com/Pilot+study+of+the+airQ+Intubating+Laryngeal+Airway+in+clinical+use.-a0225792554>
22. Joo HS, Kataoka MT, Chen RJB, et al. PVC tracheal tubes exert forces and pressures seven to ten times higher than silicone or armoured tracheal tubes: an in vitro study. *Can J Anesth*. 2002;49(9):986-989.
23. Lu PP, Yang CH, Ho AC, Shyr MH. The intubating LMA: a comparison of insertion techniques with conventional tracheal tubes. *Can J Anaesth*. 2000;47(9):849-853.
24. Kundra P, Sujata N, Ravishankar M. Conventional tracheal tubes for intubation through the intubating laryngeal mask airway. *Anesth Analg*. 2005;100(1):284-288.

Appendix

The following scales were used for assessment:

Supraglottic device insertion

Mouth opening:

0 = nil, 1 = partial, 2 = full

Coughing: 0 = nil, 1 = mild, 2 = severe

Laryngospasm: 0 = nil, 1 = mild (partial with no desaturation), 2 = severe (desaturation)

Movement (including pharyngeal structures and limbs): 0 = nil, 1 = mild, 2 = vigorous

Ease of passage: 1 = easy (smooth passage with no friction or reaction from patient), 2 = moderate (friction with cough and movement), 3 = difficult

Adequacy of ventilation: 1 = able to ventilate via manual bagging, 2 = unable to ventilate

Tracheal intubation

Cricoid manipulation: 1 = not required, 2 = required to facilitate intubation,

Ease of passage: 1 = easy (no friction, smooth passage), 2 = moderate (intubation possible, but with manipulation and a difficult passage), 3 = difficult

Post-extubation outcome

A sore throat: 0 = nil, 1 = mild, 2 = moderate, 3 = severe: based on Visual Analogue Scale (VAS) with scores of 0 (no pain) to 10 (extreme pain), then categorised into 1-3 (mild), 4-6 (moderate) and 7-10 (severe)

Hoarseness of voice: 0 = nil, 1 = mild to moderate, 2 = severe

Blood on device: 0 = absent, 1 = present