Evaluation of three adjusting manoeuvres and type of endotracheal tube in the success of air-Q™ aided tracheal intubation

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Abstract

Background: The present study observed whether the use of three different adjusting manoeuvres and use of an armoured tracheal tube would increase the success rate of tracheal intubation, aided by the air-Q™ intubating laryngeal airway (air-Q™ ILA).

Method: Fifty American Society of Anesthesiologists (ASA) I and II patients undergoing elective surgical procedures were randomly assigned to two groups. In the endotracheal tube (ETT) group, standard ETT was used, while in the armoured ETT (AETT) group, tracheal intubation was performed using AETT. After a uniform premedication, induction and relaxation technique, an appropriate sized air-Q™ ILA with ETT in-situ, was placed. After good ventilation, a flexible fibrescope was passed down the ETT, and the percentage of glottic opening (POGO) was documented. Subsequently, three adjusting manoeuvres were applied in sequence. These included firstly, backward pressure over the larynx; secondly, head extension; and lastly, neck flexion. After noting the POGO score with each adjusting manoeuvre, the incidence of successful intubation was noted, with and without manoeuvres.

Results: The best POGO score (84%) was observed with the application of backward pressure. Successful tracheal intubation was achieved in 56-60% of patients without the use of any manoeuvres, using either type of tracheal tube. For the rest, tracheal intubation was achieved using backward pressure, except in one patient from the ETT group. The incidence of successful tracheal intubation was nearly identical with either type of ETT.

Conclusion: Successful tracheal intubation can be achieved in 96% of cases using adjusting manoeuvres. The nature of the tracheal tubes did not influence the success rate.

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Introduction

The air-Q™ intubating laryngeal airway (air-Q™ ILA) is a recently introduced disposable supralaryngeal airway device. It is available in six sizes, namely 1.0, 1.5, 2.0, 2.5, 3.5 and 4.5. air-Q™ ILA offers a conduit for adequate ventilation, and also aids tracheal intubation, using a standard polyvinyl chloride endotracheal tube (ETT). The latter use of air-Q™ ILA is especially useful, since it is available in sizes ranging from 1.0-4.5, covering the tracheal intubation needs of paediatric to adult patients. However, recent observational studies have reported that when used as a facilitator for blind tracheal intubation, air-Q™ ILA allowed successful tracheal intubation in 57-77% of patients.[1-3] This success rate is appreciably low, compared to the 95% or more, achieved with Fastrach™-aided tracheal intubation.[2-4] The present study was designed to observe whether the use of three different adjusting manoeuvres, and use of an AETT, would increase the success rate of blind tracheal intubation, aided by air-Q™ ILA.

Method

After obtaining approval from the hospital ethics committee, as well as informed patient consent, 50 young (18-50 years) non-obese patients, belonging to American Society of Anesthesiologists (ASA) Class I and II of either sex, presenting for routine, non-head and neck surgery, were selected for this trial. Patients with predicted difficult intubation were excluded.

Patients were randomly assigned to either of the two groups, according to the nature of the ETT used. The method of randomisation was the Chit-in-a-box technique. In the ETT group (n = 25), the standard ETT was used, while in the armoured ETT (AETT) group (n = 25), tracheal intubation was performed using an AETT.

All patients were premedicated with oral midazolam (0.1 mg/kg) approximately one hour prior to commencing anaesthesia.

An appropriate sized air-Q™ ILA was selected for each patient (3.5 for patients weighing 50-70 kg, and 4.5 for patients weighing 70-100 kg). Prior to placement, the cuff of the air-Q™ ILA was deflated, and its posterior surface lubricated with water-soluble jelly. Water-soluble jelly was also applied to the ETT, which was then passed up and down the air-Q™ ILA tube several times, before bringing its tip to the distal opening of the air-Q™ ILA. The cuff of the ETT was inflated to prevent its dislodgment and leakage during ventilation.

All patients were placed in the supine position, with their heads resting in the neutral position. A uniform technique of induction (propofol 2 mg/kg and fentanyl 1.5 µg/kg) and relaxation (atracurium 0.6 mg/kg) was used in all patients. After reaching an appropriate depth of anaesthesia and relaxation, jaw thrust was performed by an assistant. The air-Q™ ILA-ETT assembly was gently introduced into the oropharynx. Jaw thrust assured that the epiglottis would be up and out of the way of ventilation and tracheal intubation. The air-Q™ ILA-ETT assembly was passed to about 20-22 cm for the 4.5-sized, and 18-20 cm for the 3.5-sized air-Q™ ILA. The cuff of the air-Q™ ILA was inflated, and adequacy of ventilation checked, after connecting the proximal end of the ETT to the breathing circuit. After achieving adequate ventilation as evidenced by good chest movement and capnographic curve, a flexible fibrescope was passed down the ETT, and the visualised percentage of glottic opening (POGO 0-100%)[5] was documented. Next, the following three manoeuvres were applied in sequence. Firstly, backward pressure was applied over the front of the larynx, and the POGO reassessed and documented. Secondly, backward pressure was removed, and the POGO reassessed with head extension. Lastly, the POGO score was noted while performing neck flexion. While fibrescopy was being carried out, oxygen insufflation (4 l/minute) was performed via the suction channel of the fibrescope.

After recording the POGO score in these positions, the cuff of the ETT was deflated, and the ETT advanced towards the glottis under direct fibrescopic vision in the neutral position, while keeping the fibrescope tip within the advancing ETT. If correct tracheal placement of the ETT was achieved, the cuff of the air-Q™ ILA was deflated and removed with the aid of a dedicated removal stylet. This was considered to be the first attempt at tracheal intubation. The ETT was now connected to the breathing circuit, and maintenance of anaesthesia commenced.

If the tracheal intubation failed, three adjusting manoeuvres were applied in sequence. Firstly, backward pressure was applied over the front of the larynx, and tracheal intubation was reattempted. This was counted as the second attempt at tracheal intubation. If this manoeuvre also failed, tracheal intubation was undertaken again with head extension, namely the third attempt at tracheal intubation. Lastly, if all previous attempts had failed, tracheal intubation was attempted with the head and neck in flexion position, namely the fourth attempt at tracheal intubation. If the tracheal intubation was successful without adjusting the manoeuvres, or with any of the three adjusting manoeuvres, other remaining adjusting manoeuvres were not attempted. This was in keeping with the directives of the ethics committee. During all these tracheal intubation strategies, continuous fibrescopy was performed to note the direction of the ETT, keeping the fibrescope tip just within the bevel of the ETT. If successful intubation was achieved through any of these manoeuvres, the air-Q™ ILA was removed as outlined above. If tracheal intubation failed, with or without the three adjusting manoeuvres, the air-Q™ ILA-ETT assembly was removed, and conventional tracheal intubation, aided by rigid Macintosh laryngoscope, was performed.

On removal of the air-Q™ ILA, any evidence of blood staining on its surface was noted. Patient characteristics (age and weight) of the two groups were compared using the unpaired t-test. Mann-Whitney, a non-parametric test, was used to analyse the statistical significance of the data regarding the POGO scores, intubation characteristics, and incidence of blood on the device. We expected the incidence of successful tracheal intubation to increase by 20% from 60% as reported earlier,[1] with one of our three adjusting manoeuvres. Calculations based on the significance level (alpha of 0.05) and power (beta) of 80, gives 25 as the minimum number of patients per group. A p-value < 0.05 was considered to be significant in this study.

Results

Table I shows that the mean age, weight and sex ratio of the patients in the two groups were nearly identical, and showed no statistical difference (p-value > 0.05).

All patients in the study belonged to ASA Class I, except for five patients in the ETT group, and three patients in the AETT group. All eight patients belonged to ASA Class II.

Table I: Patient characteristics in the two groups

Parameter	ETT[a] group Mean ± SD[b]	AETT[c] group Mean ± SD
Age (in years)	37.4 ± 14.2	32.3 ± 8.9
Weight (kg)	64.7 ± 8.1	68.7 ± 15.1
Sex (male:female)	15:10	11:14

a = endotracheal tube, b = standard deviation, c = armoured endotracheal tube

The placement of the air-Q™ ILA was successful on the first attempt in all patients, except in one patient of each group. In both these patients, a second attempt with jaw thrust was needed for satisfactory air-Q™ ILA placement.

Good chest movement and capnographic curve was achieved in all patients, except in one patient from the ETT group, and in two patients in the AETT group. In all three of these patients, mild leakage was detected, even after maximum permissible cuff inflation. All three leaks disappeared after cuff deflation, up and down movement of the air-Q™ ILA, and reinflation of the cuff.

The results of this study show that the best mean POGO scores were noted with the application of backward pressure over the larynx, namely the first manoeuvre. This POGO view was significantly better (p-value < 0.05) than that seen with head extension, head and neck flexion, or without manoeuvres. Flexion of the head and neck deteriorated the POGO score to a mean of 20% or less (see Table II).

Table III shows that the incidence of successful tracheal intubation was nearly identical in both the groups. This difference, and the attempts needed to achieve tracheal intubation in either group, was statistically insignificant (p-value > 0.05). We did not need to resort to the head and neck flexion manoeuvre in order to achieve tracheal intubation in any of the patients of either group.

Discussion

The results of this study have clearly demonstrated that neither the overall success of tracheal intubation, nor the attempts needed to achieve it, differ significantly with regard to using regular ETT or AETT. This is understandable as the angle at which these two tracheal tubes emerge from the air-Q™ ILA is nearly identical (see Figures 1 and 2).

Table II: Percentage of glottic opening scores, with and without manoeuvres in the two groups

Manoeuvre performed	Mean POGO[a] score ETT[b] group Mean ± SD[c]	Mean POGO score AETT[d] group Mean ± SD
Without manoeuvre	70.8 ± 35.9	70.2 ± 37.2
With backward laryngeal pressure	84.8[e] ± 29.0	84.2[e] ± 25.6
With head extension	77.4 ± 28.1	74.0 ± 28.9
With neck flexion	17.8 ± 18.1	20.4 ± 15.1

a = percentage of glottic opening, b = endotracheal tube, c = standard deviation, d = armoured endotracheal tube, e = p-value < 0.05 compared to other percentage of glottis opening scores, with and without manoeuvres in the same group

Figure 1: Angle of emergence of the armoured tracheal tube from the air-Q™ Intubating Laryngeal Mask

Figure 2: Angle of emergence of the standard endotracheal tube from the air-Q™ Intubating Laryngeal Airway

Table III: Intubation characteristics and incidence of blood on the device

Group	Intubation characteristics										Blood on the device	
	Successful intubation		Number of attempts needed for successful tracheal intubation									
	No	%	First attempt without maneouvre		Second attempt with backward laryngeal pressure		Third attempt with head extension		Fourth attempt with head and neck flexion		No	%
			No	%	No	%	No	%	No	%		
ETT[a] group	22	88	14	56	7	28	1	4	-	-	2	8
AETT[b] group	24	96	15	60	9	36	-	-	-	-	1	4

a = endotracheal tube, b = armoured endotracheal tube

The air-Q™ ILA could be successfully placed in all our patients. This was also reported by Joffe et al.[6] However, in this study, there were two air-Q™ ILA devices in the ETT group vs. one in the AETT group, which showed blood staining on removal. This may be attributed to a softer AETT, compared to a regular ETT, which is more likely to cause soft tissue trauma.

In this study, on the first attempt, without any manoeuvres, tracheal intubation via the air-Q™ ILA was achieved in 56% and 60% of patients, in the ETT and AETT groups, respectively. This is in agreement with the findings of earlier studies.[1]

Our findings also suggest that backward pressure over the larynx improves the POGO view to 84% in either group. It is this improvement in the POGO view, following application of backward laryngeal pressure, which favoured successful tracheal intubation after failure to intubate without any manoeuvre (87.5% in the ETT group, and 100% in the AETT group).

An interesting finding of this study was that even head extension improves the POGO view, though not as well as that achieved after application of backward laryngeal pressure manoeuvre. In this study, head extension manoeuvres proved to be useful when a patient of the ETT group could not be intubated with or without the backward laryngeal pressure manoeuvre. Thus, our finding suggests that the head extension manoeuvre should be adopted before abandoning tracheal intubation via air-Q™ ILA.

Although a flexible fibrescope was used in this study, its role was limited to note the POGO score and the path that the ETT would take, when passed via the air-Q™ ILA, with or without the three adjusting manoeuvres. It did not in any way assist in the placement of the ETT.

One drawback of this study was that the intubation attempt was stopped as soon as tracheal intubation was successful, with or without any manoeuvre. Thus, although all tracheal intubation attempts were initially performed without any manoeuvre, the usefulness of the three adjusting manoeuvres could not be assessed in all the patients. This was because the study design, as approved by the ethics committee, did not allow the continuation of the trial with other manoeuvres once success was achieved by an earlier manoeuvre.

In conclusion, the results of this study suggest that both backward pressure over the larynx and head extension manoeuvres improve the POGO view, and should be adopted after failure to intubate blindly in the neutral position via the air-Q™ ILA. In addition, selection of either a conventional ETT, or an AETT, did not play a role in the incidence of correct tracheal tube placement via the air-Q™ ILA.

Conflict of interest

None of the authors have any financial or personal relationships which may have inappropriately influenced the writing of this paper.

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