Comparison of two methods of gum elastic bougie aided endotracheal intubation using Airtraq® video laryngoscope

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This study was conducted to compare two methods of gum elastic bougie (GEB) aided endotracheal intubation using Airtraq® video laryngoscope.

Materials and method: In this prospective study, sixty patients undergoing elective surgery under general anaesthesia were randomly allocated into two groups. In Group P, Airtraq® was preloaded with endotracheal tube (ETT) with the GEB placed inside it up to the tip and the entire assembly is passed *en bloc* into the mouth. On visualisation of the glottis, the GEB is initially advanced across the glottis followed by railroading the ETT into the trachea. In Group S, GEB was introduced separately from the side after visualisation of the glottis using Airtraq®, followed by railroading the ETT over the GEB. Time taken for successful insertion of GEB, ease of insertion of GEB, time taken and number of attempts at endotracheal intubation were noted.

Results: As the data for time taken for GEB insertion were skewed, the statistical analysis was done using Mann-Whitney U test and median, 25th and 75th percentile values were calculated. Time taken for GEB insertion and endotracheal intubation was found to be shorter in Group P than in Group S, both the results being statistically significant. The time taken for GEB insertion was 7.71 seconds (median) in Group P and 20.44 seconds (median) in Group S, whereas time taken for endotracheal intubation was 14.68 ± 0.913 seconds vs. 29.10 ± 1.83 in Group P and Group S respectively.

Conclusion: The use of GEB preloaded into the ETT or insertion of the same from the side of the mouth while using Airtraq® proves to be a clinically effective alternative to achieve successful endotracheal intubation. Time taken to achieve successful endotracheal intubation is shorter if the GEB is preloaded into the endotracheal tube. Additional manoeuvres like external laryngeal manipulation will help in GEB advancement especially when it is inserted from the side of the mouth using Airtraq®

Keywords: Airtraq; gum elastic bougie; intubation; video laryngoscope

Introduction

Introduction of videolaryngoscope in airway management is one of the major advances in anaesthesia in recent years.

The Airtraq® is a video laryngoscope that can be used in the management of both normal and difficult airways.

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Received: 25/10/2017

Accepted: 04/12/2017

DOI: http://doi.org/10.4038/slja.v26i1.8283

Alignment of the oral, pharyngeal and tracheal axes is not required for visualising glottis.[1] A wider range of applications of Airtraq® have been described in literature including difficult airway management, as a rescue device following failed direct laryngoscopy, awake tracheal intubation, airway management of patients with morbid obesity as well as those with unstable cervical spine, and airway management in pre-hospital setings.[2-8]

Failed intubation using Airtraq® may be encountered owing to difficulty or inability to manipulate the endotracheal tube (ETT) tip across the glottis.[9] Gum elastic bougie (GEB) can be used as a rescue device in such cases.[10,11] The Airtraq® can be preloaded with the ETT with the GEB placed inside it till the tip and the entire assembly is passed

en bloc into the mouth. On visualization of the glottis, the GEB is initially advanced across, followed by railroading the ETT into the trachea. In practice, difficulties are encountered in manipulating the GEB across the glottis when inserted using the above method. To overcome these difficulties GEB can be separately introduced from the side of the mouth after visualization of the glottis using the Airtraq®, followed by railroading the ETT over the GEB. This modification may provide more space for manipulation of the GEB. Thus, the present study was designed to compare these two methods of GEB guided endotracheal intubation using Airtraq® videolaryngoscope.

Methodology

After obtaining clearance from institutional ethics committee (IEC 303/2012, Kasturba Medical College, Manipal), this prospective randomized study was carried out in 60 patients between age group 18 and 70 years and who fulfilled the criteria for American Society of Anesthesiologists Physical status I and II, undergoing elective surgical procedures under general anaesthesia and endotracheal intubation. Patients with limited mouth opening, cardiorespiratory diseases, BMI> 35kg/m^2 were excluded from the study. Patients were randomized into 2 groups using computer generated random sequence and allocation concealment was ensured using sequentially numbered opaque sealed envelopes. There were 2 observers in the study. Observer 1 was the resident in anaesthesiology, who performed the preoperative evaluation, evaluated the inclusion criteria before enrolling, obtained informed written consent for participation after explaining about the study protocol, did randomisation and recorded the observations. Observer 2 was the consultant anaesthesiologist, experienced with the use of Airtraq® performed the endotracheal intubation using one of the methods. Preoperative evaluation of the patients was done on the day prior to surgery, written informed consent obtained and anxiolytic premedication given according to their body weight on the night before and morning of the surgery. Patients were kept nil orally, 6 hours for solids and 2 hours for clear fluids. Inside the operating room, patients were monitored continuously with electrocardiogram, pulse oximeter, noninvasive blood pressure (NIBP) and capnograph ($ETCO_2$). Patients were positioned supine with head in sniffing position. After securing the intravenous (IV) access, i.v. fentanyl 2µg/kg was given. Preoxygenation was done with 100% oxygen for 3 minutes. Induction was done with i.v. propofol 2.5-3mg/kg. Loss of verbal contact was considered as end point of induction. After checking the adequacy of mask ventilation, neuromuscular blockade was achieved with vecuronium 0.1mg/kg i.v. and anaesthesia was deepened with 1.5%-2% isoflurane in oxygen to achieve a MAC of 1.0 to 1.5. After ensuring complete neuromuscular blockade by train-of- four count of 0/4 on peripheral nerve stimulator, intubation was done by observer 2 using Airtraq® size 2 for females and size 3 for males, the method depending on the group allocated. Portex ETT with 7.0mmID was used in females and 8.0 mmID in males. Patients were randomly allocated into two groups of 30 patients (Group P and Group S).

In Group P appropriate size ETT was preloaded in the guiding channel of the Airtraq® chosen for that particular patient. A GEB was inserted into the ETT with its tip placed at the level of Murphy's eye of the ETT and directed anteriorly. Airtraq® was held in the left hand and then passed into the mouth in the midline over the centre of the tongue until the tip reached the vallecula. At this point blade was elevated to lift the epiglottis and manipulated to get optimal glottic view. GEB was then passed into the trachea under vision for approximately 4-5cm and the ETT was railroaded over the GEB. The GEB was removed and the ETT was connected to the breathing circuit. Correct placement of ETT was confirmed by appearance of a normal capnogram. The ETT was moved laterally, removed from the channel and secured after confirming bilateral equal air entry over the chest. (Figure 1)

Figure 1: Intubation in Group P

In Group S, appropriate sized Airtraq® was chosen for that particular patient. Airtraq® was held in the left hand and then passed into the mouth in the midline over the centre of the tongue until tip reached the vallecula. Blade was elevated to lift the epiglottis and manipulated to get optimal glottis view. GEB was passed from the side of the mouth and advanced to get the tip in line with the glottis. The GEB was then passed into the trachea under vision, for approximately 4-5cm, stabilised and ETT was railroaded over the GEB into the trachea. GEB was removed, ETT connected to the breathing circuit and correct placement was confirmed by appearance of a normal capnogram. The device was withdrawn and the tube secured after confirming bilateral equal air entry over the chest. (Figure 2)

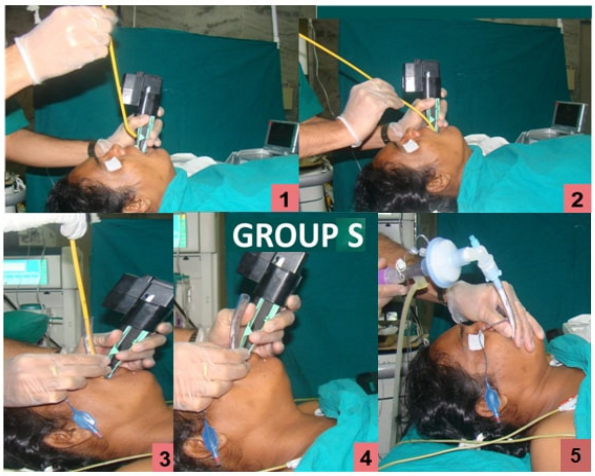

Figure 2: Intubation in Group S

When insertion of GEB was found to be difficult, external laryngeal manipulation (ELM), inclusion of epiglottis with the Airtraq® blade and rotation/ angulation of the GEB were used in decreasing order of preference to facilitate the insertion of GEB.

An intubation attempt was defined as introduction of Airtraq® between the teeth to the appearance of normal capnogram following intubation. An attempt was considered 'failed' if the time exceeded 120 seconds or a drop-in saturation below 95%. When an intubation attempt failed, patient was ventilated using face mask with 100% oxygen and isoflurane 1.5-2%, propofol 1mg/kg was given i.v. and a second attempt was done using the same technique. Any additional manoeuvres during the second attempt were noted. In case of failed intubation after two attempts, trachea would be intubated using conventional laryngoscopy.

Time taken for successful insertion of GEB assessed in our study was defined as the time in seconds from the time of obtaining optimal glottic view using Airtraq® to confirmation of successful GEB insertion and this time was measured using stop watch. Ease of insertion was described as easy when no additional manoeuvres were required to guide the GEB into trachea, moderately difficult when additional manoeuvres were required to pass the GEB into the trachea, difficult when there is inability to insert ETT in first attempt, thus requiring second attempt.

Sample size was calculated based on the time for insertion of GEB across glottis using Airtraq® laryngoscope. A difference of >15 seconds between the two groups was considered significant. To detect this difference, with P value < 0.05 and power of 80%, a sample size of 30 in each group was necessary.

Results

All patients from both groups completed the prospective study and were comparable with respect to age, body mass index (BMI) and gender (Table 1).

Table 1: Patient characteristics

Parameters	Group P (n=30) Mean ± SD	Group S (n=30) Mean ± SD	P value
Age (Years)	41.19 ± 2.14	39.83 ± 2.55	0.682*
BMI (kg/m^2)	24.44 ± 0.76	26.23 ± 0.63	0.078*
Gender (M/F)	12/18	16/14	0.301†

*Independent samples t-test
†Chi-square test

As the data for time taken for GEB insertion were skewed, the statistical analysis was done using Mann-Whitney U test and median, 25th and 75th percentile values were calculated. Time taken for GEB endotracheal intubation was found to be

shorter in Group P when compared with Group S (Table 2).

Table 2: Time taken GEB insertion and endotracheal intubation

	Group P (n=30)	Group S (n=30)	P value
Time taken for GEB insertion (sec) [Median, (IQR)]	7.71 (4.70, 9.97)	20.44 (14.22, 26.67)	0.030 (S) [@]
Time taken for endotracheal intubation (sec) (Mean ± SEM)	14.68 ± 0.913	29.10 ± 1.83	< 0.001 (S)[*]

[@] Mann - Whitney U test
IQR – Interquartile range
* Independent samples t-test
SEM – Standard error of mean
(S) – Statistically significant

Easy insertion of GEB was noticed in 24 patients of Group P and 16 patients in Group S. However, one patient had difficult intubation in Group P whereas 2 patients had difficult intubation in Group S requiring two attempts. There was no statistical difference between the two groups, P value being 0.07(Table 3).

Table 3: Ease of insertion of GEB

Group	Easy	Moderately difficult	Difficult	P value
Group P (n=30)	24	5	1	0.07[*]
Group S (n=30)	16	12	2	

[*]Fisher's exact test

Five patients in Group P and 12 patients in Group S required ELM. It was both statistically and clinically significant.

Table 4: Airway manoeuvres required

		Group P (n = 30)	Group S (n = 30)	P value
Manoeuvres	None	25	18	0.04(S)[#]
	ELM	5	12	

[#] Chi- square test, (S) Statistically significant,
ELM – External laryngeal manipulation

Discussion

The Airtraq® is a video laryngoscope that can be used for the management of both anticipated and unanticipated difficult airway. Airtraq® provides superior intubating conditions than conventional direct laryngoscopes by providing better glottic view with minimal head and neck movement.[12]In spite of better glottic view, intubation using Airtraq® may not always be successful although it reduces intubation time.[13,14] GEB when used along with Airtraq® aids in intubation and prevents repeated attempts.[10] Durga P *et al* reported the use of GEB in combination with the Airtraq® in ten patients who required multiple intubation attempts.[15]The GEB is preloaded into the ETT which in turn is loaded on the guiding channel of the Airtraq®. On visualization of the glottis, the GEB is initially advanced across, followed by railroading the ETT over it. In practice, difficulties may be encountered in manipulating the GEB across the glottis when inserted using the above method.

With this background, we hypothesised that when the GEB is inserted from the side after visualization of the glottis using the Airtraq® followed by railroading of the ETT over the GEB may provide more space for manipulation of the GEB, thus overcoming the difficulty encountered when passing preloaded assembly of GEB and ETT

across the glottis. This modified method has not been studied or published elsewhere before.

Our aim was to compare ETT preloaded GEB assisted intubation through the guiding channel of Airtraq® with that of insertion of GEB alone from the side of the mouth using Airtraq and subsequent intubation over GEB.

When the time taken for GEB insertion between the two groups as well as the time taken for intubation was compared, it was found to be statistically significant (P values being 0.03 and <0.001 respectively). However, they were not clinically significant as it only reflected the additional distance the GEB and ETT needed to pass from the side of the mouth to the trachea in Group S, whereas it was already railroaded into the guiding channel of Airtraq® in Group P. This time difference can also be attributed to the hand eye coordination required while using video laryngoscope which may be less required in patients of Group P compared to patients in Group S.

In our study one patient in Group P and 2 patients in Group S required two attempts for intubation because of poor visibility due to secretions during the first attempt.

In this study, 12 patients in Group S and 5 patients in Group P required optimization manoeuvres in the form of ELM which was both statistically and clinically significant. The lesser incidence of optimization manoeuvres in Group P may be due to the fact that the preloaded assembly of ETT and GEB are more in alignment with the glottis thereby requiring least manipulations for intubation. Dhonneur G *et al* in their study described manoeuvres involving the Airtraq tip (downward, backward and upward movement) to increase the success of intubation.[9]

In our study, all intubation was performed by the single experienced consultant and a wireless monitor was used for intubation which could be considered as merits of the study.

There were some limitations in our study. As it was impossible to blind the anaesthesiologist to the method being used for intubation, we acknowledge the potential for existence of observer bias. Our study was done in a limited number of patients with clinically normal airway. So, whether the results of this study can be extrapolated to patients with difficult airway can only be confirmed by further studies.

Conclusion

The use of gum elastic bougie preloaded into the endotracheal tube or insertion of the same from the side of the mouth when using Airtraq® proves to be a clinically effective alternative to achieve successful endotracheal intubation. Time taken to achieve successful endotracheal intubation is shorter if the gum elastic bougie is preloaded into the endotracheal tube. External laryngeal manipulation will help gum elastic bougie advancement especially when it is inserted from the side of the mouth using Airtraq®.

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