

A COMPARATIVE STUDY BETWEEN LIGHT WAND AND AIRTRAQ AIDED TRACHEAL INTUBATION FOR ADULT PATIENTS WITH DIFFICULT AIRWAY UNDERGOING ELECTIVE SURGERY UNDER GENERAL ANESTHESIA

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ABSTRACT

Objective: The objective of the study was to compare airtraq (AT) intubations and lightwand (LW) intubations in terms of safety, efficacy, ease of intubation, hemodynamic variabilities, and post-operative outcomes.

Methods: A cross-sectional and randomized comparative study was conducted on sixty adult patients with a predicted difficult airway, scheduled to undergo elective surgery under general anesthesia using AT and LW intubation.

Results: All the cases in both the AT group and LW group were successfully intubated, with an overall success rate of 100% in both groups. The success at the first attempt in AT group was 96.66% and that of LW group was 73.33%.

Conclusion: AT had superior successful intubation conditions than LW. However, both LW and AT were proved to be safe and successful techniques of intubation in difficult airway patients.

Keywords: Difficult airway, Airtraq, Light wand, General anesthesia, Intubation.

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INTRODUCTION

Airway management is often considered one of the most challenging tasks encountered [1] in anesthesia practice. When a conventionally trained anesthesiologist experiences difficulty with mask ventilation of the upper airway or difficulty with intubation, it is termed difficult airway [1]. Any failure to intubate the trachea can cause morbidity and is the leading cause of mortality in anesthesia [2].

An intubation is called difficult if a normally trained anesthesiologist needs more than 3 attempts or more than 10 min for a successful endotracheal intubation. The incidence of failed intubation is 0.13–0.3% in the operating rooms [3].

Fiber optic intubation was a well-established and resourceful tool for managing the airway in patients with suspected or known difficult airways. Obtaining and preparing a FOB is more laborious and time-consuming, and skill demanding to operate a FOB. To overcome these disadvantages, alternative techniques of intubation were looked into.

In view of the advantages such as simple technique of usage, precise visual control, shorter intubation time, and easy learning curve, video laryngoscopes gained popularity and led to the development of a plethora of video laryngoscopes since 2000 [4] (Fig. 1). Airtraq® (AT) is a newer tracheal intubation device, which comes under the section of video laryngoscope. It consists of a side channel to pre-mount the endotracheal tube.

Other alternative techniques of intubation were also developed over the years. One such alternative was light-guided intubation using the principle of transillumination. Several lighted styles came into existence that was used as instruments for tracheal intubation (Fig. 2). The lightwand (LW) comes under the category of stylets and bougies. It consists of a handle and a malleable stylet with a light bulb at its distal end [5]. The endotracheal tube is pre-mounted on the stylet with the help of a latch.

As most of the previous studies were manikin studies or simulated difficult airway studies, this study was designed to be conducted in adult patients with predicted difficult airways to find out whether there was any significant difference between LW and AT intubations, especially in terms of safety and efficacy.

Aim of the study

This study aims to compare AT intubations and LW intubations in terms of safety, efficacy, ease of intubation, hemodynamic variability's, and post-operative outcomes.

MATERIALS AND METHODS

A cross-sectional and randomized comparative study was conducted at GITAM Institute of Medical Sciences and Research Hospital, Visakhapatnam, between June 2021 and June 2022, after approval from the Institutional Ethics Committee. Written informed consent was obtained from the patients selected for the study.

A total of sixty adult patients were taken up for the study. The patients aged 18–60 years, belonging to the American Society of Anesthesiologists I and II physical status, scheduled to undergo elective surgery under general anesthesia were included in the study.

Group AT: 30 patients were intubated using the AT video laryngoscope intubation technique.

Group LW: 30 patients were intubated using the LW guided intubation technique.

Patient refusal, patients posted for emergency cases, patients with respiratory tract pathology (intrinsic laryngeal abnormalities), inability to cooperate with adequate airway assessment, history of cardiovascular, hepatic, renal and coagulation diseases, pregnancy, and risk of regurgitation and aspiration were excluded from the study.



Fig. 1: Airtraq with ET tube ready for intubation

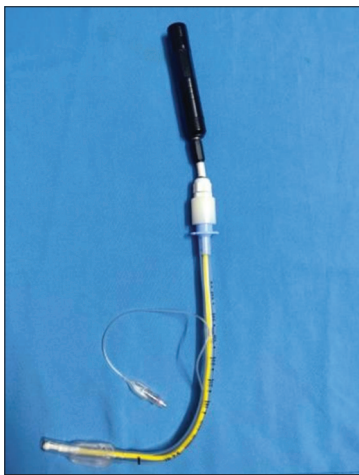


Fig. 2: Lightwand with ET tube ready for intubation

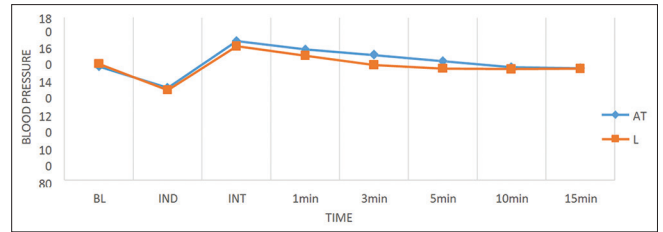


Fig. 5: Systolic blood pressure

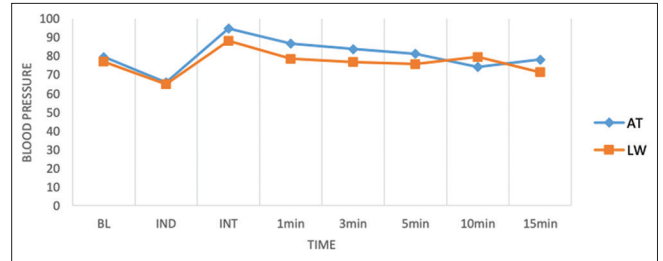


Fig. 6: Diastolic blood pressure

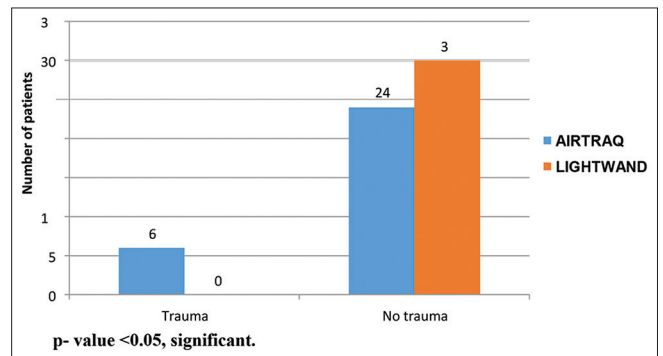


Fig. 7: Trauma

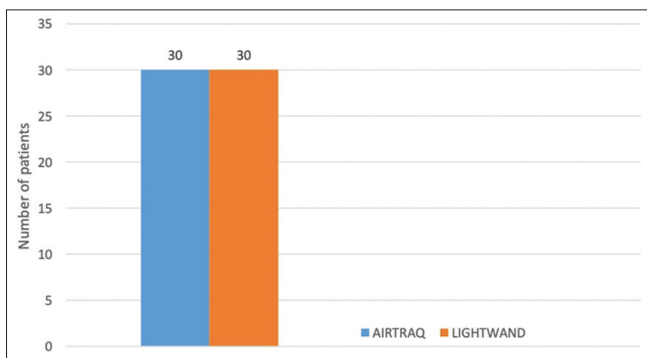


Fig. 3: Overall success of intubation

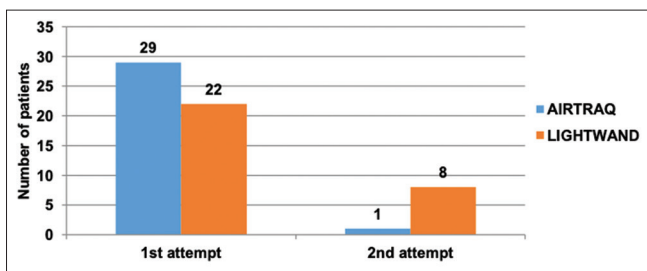


Fig. 4: Success at first attempt

Methodology

All the patients recruited for the study were admitted the day before surgery and assessed (Table 1). The technique of anesthesia was standardized for both groups. All patients were premedicated with tablet alprazolam 0.25 mg and tablet ranitidine 150 mg with sips of water, the night before surgery. The patients were instructed to be on fasting for at least 6 h for solid food and 2 h for clear fluids.

In the operating room, a 18-G intravenous cannula was secured on either of the hands and a continuous infusion of ringer lactate started. All the standard monitors were applied to the patient and baseline parameters such as non-invasive blood pressure (NIBP), heart rate (HR), and peripheral oxygen saturation (SpO₂) were recorded.

Each patient was kept in a supine position. Trial ventilation was conducted in the operation theater. The patients were then premedicated with glycopyrrolate (0.005 mg/kg), midazolam (0.05 mg/kg), fentanyl (2 mcg/kg), and anesthesia who were induced with thiopentone sodium (5–7 mg/kg). Patients' lungs were manually ventilated with a bag and mask and pre-oxygenated with 100% oxygen for 3 min. Intubation was facilitated with succinylcholine 2 mg/kg. With the head in a neutral position, each patient was intubated with either of the instruments.

Immobilization techniques such as manual in-line stabilization, and optimization maneuvers such as a head extension or jaw thrust, were used after each failed attempt. After intubation, the lungs were mechanically ventilated using closed-circuit controlled ventilation

Table 1: Predictors of difficult airway

Previous history of difficult intubation
Mallampati Class II or III
Mouth opening (interincisor distance) <30 mm
Thyromental distance <60 mm

*Patients with any one of the predictors of a difficult airway were included in the study. The above patients were randomly assigned to two groups

Table 2: Overall success of intubation

Group AT (n=30), n (%)	Group LW (n=30), n (%)	p	Significance
30 (100)	30 (100)	1.00*	NS

*p>0.05, NS. AT: Airtraq, LW: Lightwand, NS: Not significant

Table 3: Success at first attempt

Number of patients	Group AT (n=30), n (%)	Group LW (n=30), n (%)	p	Significance
1 st attempt	29 (97)	22 (73)	0.026*	S
2 nd attempt	1 (3)	8 (27)		

*p<0.05, significant. AT: Airtraq, LW: Lightwand, S: Significant

Table 4: Visual analog scale for sore throat

Measure	Group AT (n=30)	Group LW (n=30)	p	Significance
Mean	5.13	2.83	0.0001*	S
SD	0.78	0.95		

AT: Airtraq, LW: Lightwand, SD: Standard deviation, S: Significant. *p<0.05, significant

along with end-tidal sevoflurane 0.2–1%, and 66% of nitrous in oxygen mixture for maintenance and timed vecuronium doses.

The primary end point was a successful placement of an ET tube in the trachea. The secondary end points were the duration of intubation, success at the first attempt, and a number of attempts required.

An attempt was defined as the withdrawal of the device from the mouth followed by repositioning. Failure to intubate was defined as esophageal intubation, inability to place the tracheal tube into the trachea within 120s or more than three attempts required. The duration of the intubation attempt was defined as the time taken from the insertion of the intubation device between the teeth to the time when the device was removed from the oral cavity.

The hemodynamic parameters recorded were systolic blood pressure, diastolic blood pressure, HR at the time of induction, intubation, 1 min, 3 min, 5 min, 10 min, and 15 min post-intubation. They were also monitored closely all through the surgery. The incidence of trauma in intubated patients was recorded by the presence of blood on the ET tube after extubation. The post-operative sore throat was scored 30 min after extubation in the recovery room using VAS (0=No pain to 10=Worst imaginable pain).

In case of failure after three attempts with either of the devices, backup resources such as a conventional laryngoscope with a bougie or a fiber optic bronchoscope were kept readily available.

Statistical analysis

The categorical variables in the study were recorded as frequency and percentage analysis. The continuous variables were recorded as mean and standard deviation. The qualitative data of the study were analyzed using the Chi-square test. For analyzing quantitative data, the Mann-Whitney U-test was utilized. The duration for intubation attempts

was analyzed using an unpaired T-test. All the data were recorded in Microsoft Excel data sheets, and data analysis was performed using SPSS software version 20. A p-value of less than 0.05 was taken as the level of significance.

RESULTS

The overall success of intubation, success at first attempt, and duration of intubation were the parameters compared between the two groups (Figs. 3 and 4).

Hemodynamic parameters were compared from the pre-induction (baseline) values to the time of induction, intubation, 1 min, 3 min, 5 min, 10 min, and 15 min after intubation (Figs. 5 and 6).

Trauma occurred during intubation was noted by the evidence of blood on the endotracheal tube (Fig. 7).

Post-operative complications like sore throat were assessed 30 min after extubation, in the recovery room by visual analog scale (VAS).

The categorical variables in the study were recorded as frequency and percentage analysis. The continuous variables were recorded as mean and standard deviation. The qualitative data of the study were analyzed using the Chi-square test. For analyzing quantitative data, the Mann-Whitney U-test was utilized. The duration for intubation attempts was analyzed using an unpaired T-test. All the data were recorded in Microsoft Excel data sheets, and data analysis was performed using SPSS software version 20. p<0.05 was taken as the level of significance.

All cases in both AT and LW groups were successfully intubated by either instruments. The p-value was 1, which was >0.05; hence, though both groups were comparable, the difference was not statistically significant (Table 2).

A total of 29 cases in AT group were intubated in the first attempt. Only one case required a second attempt. This was because of the occlusion of glottic vision by secretions (Table 3).

A total of 22 cases in LW group were intubated in the first attempt and eight cases required a second attempt. Two cases in LW group faced difficulty in advancing the stylet after tracheal transillumination was seen. In three cases, because of thick skin over the front of the neck, tracheal transillumination was not clearly visualized, hence required a second attempt with dimming the OR lights. In three cases difficulty in introducing, the tube was observed because of resistance offered by a large tongue, a moderately large thyroid goiter, and a short neck. The value was <0.05; hence, the difference was statistically significant.

In six cases intubated with AT, there was trauma to the airway structures. No cases in the LW group had trauma.

The p-value was 0.023, and the association was said to be statistically significant.

The VAS score in AT group was 5.13±0.78. The VAS score in LW group was 2.83±0.95 (Table 4).

p<0.05, this difference was considered to be extremely significant.

There was a fall in blood pressure at the time of induction. The pressure changes at the time of intubation, 1 min, 3 min, and 5 min were significantly higher in AT group. The difference in both groups was said to be statistically significant.

DISCUSSION

The primary objective of the study was to successfully intubate the patient, with either of the two instruments. The time taken for intubation was counted from the time; the instrument was inserted

between the teeth; to the time, it was withdrawn from the oral cavity. The number of attempts required to intubate the patient was noted down. Hemodynamic changes in terms of systolic and diastolic blood pressure were measured from pre-induction to 15 min after intubation.

In this present study, all the cases in both the AT group and LW group were successfully intubated, with an overall success rate of 100% in both groups. The success at the first attempt in the AT group was 96.66% (29/30), and that of the LW group was 73.33% (22/30). The p-value was 0.026 and was said to be statistically significant.

Wu *et al.* [6] stated in their study that the overall intubation success rate in the LW group was 80% (24/30), in comparison with direct laryngoscope 96.7% (29/30). The success at the first attempt in the LW group was 63.3% (19/30) and in the DL group was 83.3% (25/30).

Maharaj *et al.* [7] compared AT and Macintosh laryngoscope in routine airways. The overall success rate was 100% in both groups. All patients were successfully intubated in the AT group in the first attempt (100%), whereas one patient required more than one attempt with a Macintosh laryngoscope (96.7%).

In the study of Durga *et al.* [8], a comparison of AT and Mc Coy laryngoscope in patients with cervical immobilization was done. About 93.3% of patients in the AT group were intubated in the first attempt, and in the laryngoscope group, 76.7%. There were also published reports that AT was superior in laryngoscopy in both normal airways as well as in simulated difficult airway scenarios [9].

The time taken for intubation in this study was 22.44 ± 3.74 s in the AT group and 22.9 ± 4.18 s in the LW group, the p-value was 0.65. This states that there was no statistical significance between AT and LW in terms of time taken for intubation.

In the study by Park *et al.* [10], the duration of intubation for AT was 13.5 s and for LW was 14.2 s. There was no statistically significant difference in intubation time between both groups.

The intubation time in the study by Wu *et al.* [6] was 63.3 ± 27.5 s in the LW group which was almost equivalent to 61.8 ± 8.7 s in the direct laryngoscope group. There was no statistically significant difference between the two groups.

In the study conducted by Yang *et al.* [11], Glidescope took 17 s longer than LW (46.9 ± 18.4 s vs. 29.5 ± 17.7 s). They stated that, if there are no desaturation episodes, the time for intubation can be acceptable in both groups. However, in patients with poor pulmonary reserve as in pregnancy, obesity, lung disorders, or spine abnormalities, this difference can become significant.

Six cases in the AT group sustained trauma during intubation. There were no cases of trauma in the LW group. The p-value of this parameter is 0.023, and hence, there is a statistically significant difference between the two groups.

Agrò *et al.* [12], in their review article, stated that there were reports of low incidence of mucosal injuries due to LW. This article also concluded that LW was associated with minimal trauma and no dental trauma; henceforth, it was advantageous in patients with fixed dental problems.

The baseline values of systolic blood pressure and diastolic blood pressure in the AT and LW groups were comparable and were without any statistical difference. A fall in SBP values was observed in both groups at the time of induction, mostly because of the drugs used for the induction of general anesthesia. There was an increase in the SBP values at the time of intubation. The difference between the two groups at the time of intubation, 1 min, 3 min, and 5 min was statistically significant ($p < 0.05$). The SBP readings of the LW group returned to baseline values by the end of 5 min, whereas patients in the AT group had elevated

readings even after 5 min and tended to reach the baseline after 10 min of intubation. The DBP at the pre-induction time in AT and LW groups were comparable, and no statistical difference was found. There was a generalized fall of DBP at the time of induction which was an effect of drugs given for induction. The DBP values started to increase from the time of intubation. However, the readings returned to normal by the end of 3 min in the LW group and by the end of 5 min in the AT group. After 10 min of intubation, there was no statistically significant difference between both groups either in SBP or DBP readings.

McElwain and Laffey [13] opined that there was no difference between AT and DL in hemodynamic profile. Even though the AT did not require an axes alignment for visualization of the glottis, the bulkier size of the blade, greater stretching of the tissues, longer duration of intubation, and inability to pass the tube even after visualization of cords, were the inciting factors for an exaggerated sympathetic response.

Hirabayashi *et al.* [14] observed no difference in hemodynamic changes between LW and DL groups. They found that the jaw grasp and thrust upward to clear the tongue and epiglottis off the pharyngeal wall were enough to cause hemodynamic changes similar to that of DL. Hence, they concluded that there was no added advantage of LW over DL, in terms of hemodynamic responses.

A meta-analysis by Lu *et al.* [15] confirmed that AT produced less hemodynamic variabilities, and this advantage could be utilized in geriatric patients as well as in patients with coronary artery disease or hypertension. Schälte *et al.* [16] used AT for ETT in high risk cardiac surgical patients. They concluded that AT maintained a stable hemodynamic situation.

The mean standard deviation for VAS for post-operative sore throat in the AT group was 5.13 ± 0.78 and that of the LW group was 2.83 ± 0.95 . The patients in the LW group experienced sore throats lower than that of the AT group, and this difference was found to be extremely statistically significant, as $p < 0.0001$.

Park *et al.* [10] reported a mean VAS score of 2 in the AT group and 2 in the LW group and this difference was not statistically significant.

Amir *et al.* [17] reported that complications like post-operative sore throat were higher in the video stylet group than FOB group. This was because of the increased number of attempts as well as the rigidity of the video stylet. In previous studies with optiscope, the incidence of sore throat was comparable to that of the conventional laryngoscope.

There were certain limitations to the study. It was a comparative study without any control group; hence, comparison with conventional techniques was not done. Further, this study was done in a limited number of subjects and for a shorter period of time. The results may vary if done in a large number of subjects. An observer could not be blinded for obvious reasons, so the chances of observer bias were high.

As both AT and LW were successful in difficult airway management, the future scope of the study is to evaluate their efficacy in emergency intubations and in pediatric difficult airway management.

CONCLUSION

It can be concluded from this study that AT had superior successful intubation conditions than LW. However, both LW and AT were proved to be safe and successful techniques of intubation in difficult airway patients.

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AUTHORS' CONTRIBUTIONS

Conceptualisation, Drafting -Mythili K., Aman San G.

Editing-M Venkata Ganesh.

COMPETING INTERESTS

Nil.

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