

“Light wand- guided nasotracheal intubation in patients with limited mouth opening: a comparison with blind nasal intubation”

Subhash¹, Vipin Kumar Dhama², Bhagat Singh³, Yogesh Manik⁴, Nikhil Dewan^{5,*}

¹Professor Head, ²Associate Professor, ³Professor, ⁴Assistant Professor, ⁵Junior Resident, LLRM Medical College, Meerut

***Corresponding Author:**

Email: ndewan_24@yahoo.co.in

Abstract

Background and objectives: Approximately 1–3% of surgical patients have difficult airways, which accounts for the most important cause of anaesthesia-related morbidity and mortality. The fiberoptic bronchoscope is considered the gold standard for the management of difficult airways. However, blind nasal intubation remains a basic technique in developing countries, especially in remote areas where a Fiberoptic bronchoscope is not always available. The light wand is a simple, cost effective device, and has become a tool widely accepted in airway management under various clinical scenarios, including difficult airways.

The study was conducted to evaluate the efficacy of light wand-guided nasotracheal intubation over blind nasal intubation.

Methods: A total of 60 ASA Grade I & II patients of age 18-60 yrs of Body mass index between 18-25 kg/m² with limited mouth opening (distance between upper and lower central incisors < 3.0 cm) posted for elective surgeries were divided into two equal groups in a randomized, double-blind fashion.

Blind nasal group 30 patients

Light wand Group: 30 patients

Results: The first attempt and overall success rate of light wand guided nasotracheal intubation was 80% and 90% respectively, significantly higher than blind nasal intubation i.e. 50% and 66.66% respectively (p<0.05). The mean intubation time in light wand group was 103±61 seconds and was 155±73 seconds in blind nasal group (p<0.05). There was significantly better haemodynamic stability and a lower incidence of pharyngalgia in lightwand group.

Interpretation & Conclusions: The study shows nasotracheal intubation using the light wand to be a more effective and simple approach than blind nasal intubation, with a higher success rate, better haemodynamic stability, and fewer postoperative complications in patients with a known or anticipated difficult airway.

Keywords: Adult, Blind nasotracheal intubation, Transillumination

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Introduction

Approximately 1–3% of surgical patients have difficult airways, and difficult airways are the most important cause of anaesthesia-related morbidity and mortality.¹

The fiberoptic bronchoscope (FOB) is considered the gold standard for the management of difficult airways. However, blind nasal intubation remains a basic technique in developing countries, especially in remote areas where a FOB is not always available.

In contrast to direct laryngoscopy, light wand-guided intubation does not depend on the anatomical structure of the upper airway, therefore the light wand has an advantage in difficult airway management and is already sometimes regarded as the first-line option for a failed laryngoscopic intubation.^{2,3} In addition, the illumination of the light wand is not influenced by

blood or secretions, so the light wand can be more effective than the FOB in patients with active bleeding in the oral cavity following faciomaxillary trauma.⁴

Lighted stylet guided intubation can be a useful technique for oral and nasal intubations in both asleep and awake patients.^{5, 6} This technique may also be helpful in patients with anterior larynx, scarring, or a bloody airway, because the lighted stylet has no optical viewing element. A decreased incidence and severity of sore throat and hoarseness has also been reported in comparison to direct laryngoscopy.⁷

Blind nasal intubation is easier to describe than to perform. Blind nasal intubation is an important skill for Anaesthesiologist as it remains an important adjunct in the management of difficult airway. Indications for this technique include potentially difficult oro-tracheal intubation and patients in whom muscle relaxants or a surgical airway are undesirable or contraindicated.

The former situation may include patients with dental fractures, arthritis or dislocations of Temporomandibular Joints, a small mouth, a short neck or cervical spine immobility.

The purpose of this study was to compare the efficacy of lightwand-guided nasotracheal intubation with blind nasal intubation in patients with limited mouth opening.

Materials and Methods

The study was done at LLRM Medical College from June 2014 to June 2015. Only one trainee anaesthesiologist having more than two years experience did all the intubation under guidance of a consultant (more than five years experience). A total of 60 patients of American Society of Anaesthesiologists physical status I or II, aged 18 – 60 yrs, with BMI 18-25 kg/m² having a limited mouth opening (distance between upper and lower central incisors < 3.0 cm), undergoing elective upper abdominal and gynaecological surgeries were divided into two equal groups in a randomized fashion using sealed envelope method.

Blind Nasal Group: Blind Nasal Intubation

Lightwand Group: Lightwand guided nasotracheal intubation

A thorough pre-anaesthetic checkup was done including the detailed history and physical examination. Patients having any major cardiovascular, neurological or respiratory illness, coagulopathy, basal skull fracture, nasal bone fracture, nasal mass, upper airway foreign body, cervical instability, or a history of upper airway surgery were ruled out from the study.

Patients were referred for ENT examination to exclude any anatomical abnormalities of upper airways.

On arrival in the operation theatre, the monitor (Fabius plus- Infinity Vista XL) was attached to the patient and the baseline values were recorded before administration of any drug.

One puff (10 mg) of Lidocaine 10% (LOX 10% Spray, NEON) was sprayed on the mucosa of the nasopharynx and oropharynx. Furthermore, the nasal mucosa was prepared with 1 teaspoon of 2% lidocaine jelly and three drops of 2% xylometazoline hydrochloride nasal drops in each nostril in all patients.

The lightwand (*a GE healthcare product*) consists of a stylet, light source and a tube fixer.

A smaller size endotracheal tube was chosen (7.0 mm ID for males and 6.5 mm ID for females). A water soluble lubricant jelly was applied over the stylet and it was inserted into the endotracheal tube till the bulb tip lies just proximal to the tip of endotracheal tube. The Lightwand- ET assembly was then bent at a 90° angle just proximal to the cuff of the tube. The tube fixer was then fixed on the lightwand.

In both groups, the patient's head was placed in a supine and neutral position. Before induction, 100% oxygen was administered for 5 min using bag and mask technique and oxygen saturation (SpO₂) was maintained at 100%.

All patients were pre-medicated with inj. Glycopyrrolate 0.2 mg, inj. Midazolam 1 mg, inj. fentanyl 2µg/ kg intravenously 15 minutes before induction. Inj. Ketamine and inj. Propofol were prepared in separate 10 ml syringes. Inj. Ketamine was given as a single bolus in a dose of 0.5 mg/kg intravenously. Inj. Propofol was given in a total dose of 1 mg/kg

intravenously with first 50% of the dose as a single bolus and the remaining dose as an incremental dose of 10 mg. The wider nasal cavity was chosen by inspection and asking the patient which nostril was easier to breathe with.

In the lightwand group, the endotracheal tube was inserted into the nostril and advanced perpendicularly until the tube tip break through the posterior nares, which was indicated by a sense of sudden decreased resistance. Overhead OT lights were switched off during procedure. Guided by the light spot in the neck, the lightwand was pushed forward, rotated towards left or right, or moved slightly downward until a bright spot of light was visible at the cricothyroid membrane. Finally, the right hand fixed the lightwand, the left hand pushed the endotracheal tube into the trachea, and then the lightwand was withdrawn.

In the blind group, the direction of the endotracheal tube was guided through the patient's breathing. At the point of maximal breath sounds, the tube was supposed to be lying at the level of glottis, and then the tube was pushed forward into the trachea during inspiration. Successful intubation was confirmed by lung auscultation and end-tidal capnography, and then vecuronium 0.1 mg/kg was administered intravenously and mechanical ventilation was performed.

If the intubation was unsuccessful after three attempts, it was considered as failed & not included in our study. The intubation time was defined as the period from the insertion of the endotracheal tube into the nostril to successful intubation confirmed by end-tidal capnography.

During intubation, if the SpO₂ was less than 90%, the lightwand was withdrawn, the opposite nostril and mouth were covered by hand, and ventilation through the endotracheal tube was followed.

SpO₂, ECG, NIBP, etCO₂ observation was done throughout the procedure.

Mean arterial pressure (MAP) and heart rate (HR) were recorded at the following time-points: baseline value, T1; during intubation, T2; 1 min after intubation, T3; and 3 min after intubation, T4; and 5 min after intubation, T5.

All the patients were reviewed for complications including Hoarseness, epistaxis and pharyngalgia for next 24 hrs. Hoarseness was defined as harsh voice, Epistaxis was defined as bleeding through nose during the procedure. Pharyngalgia was defined as pain in throat within 24 hours of procedure.

Statistical Methods

The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 15.0 statistical Analysis Software. The Qualitative data are represented in Number (%) and Mean±SD. The independent samples Student *t*-test was used to determine the differences in basic clinical characteristics, MAP, HR and intubation time between

the two groups. Quantitative data, presented as the proportion or number, were evaluated by Chi square test. For the study, minimum sample size was 30 with a error 5% and confidence level 95%.

Results

There were no significant differences in patient's demographic profile, including gender, age, height, weight, and BMI between the two groups.

Table 1: Demographic profile of patients

	Blind Nasal Group (n=30)	Lightwand group (n=30)	p- value
Gender (M/F)	14/16	16/14	0.605
Age in yrs Mean±SD	38±11	35±10	0.25
Height (cm) Mean±SD	164.9±5.9	165.8±7.7	0.587
Weight (kgs) Mean±SD	53.8±7.2	56.4±8.9	0.215
BMI (kg/m ²)	20.2±1.63	20.6±1.80	0.395
Nostril (Right/Left)	18/12	21/9	0.416

No significant difference between the groups, p>0.05.

Table 2: Baseline hemodynamic parameters of the subjects

	Blind Group (n=30)	Lightwand Group (n=30)	p- value
Baseline Heart Rate (bpm)	90.5±14.7	89.8±12.8	0.859
Baseline MAP (mm Hg)	95.4±8.39	94.5±7.19	0.629

No statistically significant difference in baseline haemodynamic parameters between the groups, (p>0.05).

Table 3: Comparison in heart rate (per min) changes at different time intervals b/w two groups

Time Interval	Blind Group	Lightwand Group	p- value
T1- Baseline	90.5±14.7	89.8±12.8	0.859
T2- During Intubation	115.1±11.5	107.4±14.3	0.026*
T3- 1 min after Intubation	108.4±14.6	100±12.96	0.021*
T4- 3 min after Intubation	102.1±12.28	97.9±11.7	0.188
T5- 5 min after Intubation	94.7±9.42	91.53±10.19	0.207

*- Significant difference in heart rate change

Hence, the result is significant at T2 and T3 i.e. Variation in heart rate between two groups is statistically significant during intubation and 1 min after intubation.

Table 4: Comparison in MAP (mm Hg) changes at different time intervals b/w two groups

Time Interval	Blind Group	Lightwand Group	p- value
T1- Baseline	95.4±8.39	94.5±7.19	0.629
T2- During Intubation	116.9±10.79	110.5±11.5	0.030*
T3- 1 min after Intubation	110.25±8.03	104.2±9.12	0.008**
T4- 3 min after Intubation	103.04±7.22	101.17±10.09	0.413
T5- 5 min after Intubation	97.14±7.4	95.6±9.77	0.439

* - Significant difference in MAP change

** - highly significant difference in MAP change

Hence, the result is significant at T2 and T3 i.e. Variation in MAP between two groups is statistically significant during intubation and 1 min after intubation.

Intubation Outcomes

Table 5: First attempt and overall success rate of the two study groups

	Blind Group (n=30)	Lightwand Group (n=30)	P- value
First attempt Success Rate	15 (50%)	24(80%)	0.014*
Overall Success Rate	20 (66.66%)	27 (90%)	0.028*

*- Significant difference between the two groups, p < 0.05.

Table 6: Mean Intubation Time of the two study groups

	Blind Group (n= 20)	Lightwand Group (n=27)	P- value
Mean Intubation Time (in sec)	155±73	103±61	0.014*

*- Significant difference between the two groups, $p < 0.05$.

Complication Outcomes

Table 7: Comparison of complication outcomes between the two study groups

Complications	Blind Group (n=30)	Lightwand Group (n=30)	P- value
Pharyngalgia	12 (40%)	4 (13.33%)	0.019*
Hoarseness	3 (10%)	2 (6.66%)	0.64
Epistaxis	6 (20%)	6 (20%)	1

*- Significant difference between the two groups, $p < 0.05$.

Discussion

Nasotracheal intubation using a light-guided device has been reported since 1959. Studies have described total intubation success rates ranging from 86.2% to 100%, with a mean duration of intubation ranging from 19.7 s to 194 s, in patients with a difficult airway.^{8,9}

For blind nasotracheal intubation in patients with spontaneous breathing, Chung et al¹⁰ recommend a neutral position of head without a pillow for correct alignment of the tube tip with the glottis. The epiglottis is lifted off the posterior pharyngeal wall when the head is extended or kept in a neutral position.

When used in combination with Propofol, Ketamine has been shown to reduce the dose of Propofol necessary to achieve adequate sedation.¹¹ The combination of Ketamine and Propofol is also found to have better haemodynamic response than Propofol alone.¹²

The present study showed an overall intubation success rate of 90% for lightwand group and 66.66% for blind nasal group which was statistically significant ($p = 0.028^*$). The first attempt success rate was also more in the lightwand group (80%) than in the blind nasal group (50%) and was found to be statistically significant ($p = 0.014^*$). Similarly, the mean intubation time was seen to be less in the lightwand group (103 sec) than in the blind group (155 sec) and was statistically significant ($p = 0.014^*$). It is clear that the nearly 23.33% higher success rate and 52 seconds shorter intubation time with the lightwand intubation compared to the blind intubation is of clinical significance.

We found that endotracheal intubation using the lightwand was an easily learned, safe, effective, and rapid alternative method for airway management. These findings are in agreement with the recent study by Ellis et al.¹³, in which endotracheal intubation with the lightwand was compared with direct laryngoscopy.

Compared with blind nasal intubation only through breath sounds, the lightwand used a transillumination principle and provided a visual indicator on the neck, thus contributing to the precise positioning of the tube tip at the glottis, increasing the intubation success rate and shortening the intubation time.

An important advantage of the lightwand over blind nasotracheal intubation is the fact that the lightwand can be used in an apnoeic patient.

Just like orotracheal intubation, some studies have shown the difficulty of nasotracheal intubation using the lightwand not to be influenced by the anatomic variability of the air passage and also found the intubation time and success rate to have no relationship to the interincisive gap.⁹

With regard to haemodynamic changes, our study showed that increased Mean Arterial Pressure and heart rate during intubation occurred in both groups and was significantly higher in the blind group compared to the lightwand group.

Due to similar local anaesthesia, nasal mucosa preparation, intravenous induction agents used, in both the groups, the difference in haemodynamic may be due to prolonged stimulation of nasal, pharyngeal mucosa in blind nasal group.

This result is consistent with those of the studies of Nishikawa et al¹⁴ and Takahashi et al¹⁵. In a small study ($n = 40$), they showed that the lighted-stylet technique significantly attenuates hemodynamic changes after intubation in comparison with the laryngoscopic technique in normotensive patients. However, they did not find any significant difference in hemodynamic changes between the two techniques in patients with hypertension. So it is possible that the reduced intubation time may be associated with a reduction in both haemodynamic responses and mucosal injury.

With regard to complications, our study shows that there was a lower incidence of pharyngalgia in the lightwand intubation group than in the blind nasal group and was statistically significant ($p = 0.019^*$), which might be attributed to a shorter intubation and contact time of the intubation devices with the pharyngeal mucosa.

The incidence of hoarseness was similar in both the groups. This was consistent with the study done by Y Dong et al¹⁶ who observed no significant difference in hoarseness in their study while comparing blind nasal & lightwand guided nasal intubation.

As the lightwand has a slightly harder metal stylet, it was anticipated that the incidence of epistaxis in the lightwand intubation group would be higher compared to that in the blind intubation group. However, no difference in incidence of epistaxis occurred. Maybe the adequate preparation of the nasal mucosa with xylometazoline drops and water soluble lubricant jelly, correct remodelling of the lightwand, and gentle manipulation of the endotracheal tube by the anaesthesiologist contributed to this.

The major disadvantage of the lightwand technique is the need for an extra piece of equipment with the ever present risk of equipment failure, which contrasts with the blind nasal technique and its lack of required equipment. There is also a theoretical risk of a fatal complication of dislodgement of the light bulb into the bronchus. However, this can be minimized by correct modelling of the equipment.

The need to dim the ambient light may also be viewed as a disadvantage.

However, we believe that the benefits of faster intubation, less trauma, and lack of a need for a spontaneously ventilating patient far outweigh the disadvantages.

Limitation

Limitations of our study are a small sample size, exclusion of paediatric and pregnant patients and the trainee anaesthesiologist performing both procedures might have created bias for lightwand group.

Conclusion

In conclusion, this study showed nasotracheal intubation using the lightwand to be a more effective and simple approach than blind intubation, with a higher success rate, lower haemodynamic responses, and fewer postoperative complications in patients with a known or anticipated difficult airway.

Lightwand-guided nasotracheal intubation could be used as a simple and practical approach for difficult airways, especially in hospitals where a Fibre Optic Bronchoscope is not available. We recommend the lightwand technique as an easily learned, highly efficacious method for endotracheal intubation of the awake patient, as well as for management of the difficult airway.

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