ORIGINAL ARTICLE

Use of lightwand for nasotracheal intubation in adult patients with limited mouth opening undergoing elective surgery

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ABSTRACT

Objective: Lightwand is a device which utilizes the principle of transillumination to assist endotracheal intubation.The authors evaluated the role of lightwand for nasotracheal intubation in patients having limited mouth opening on PAC assessment. Lightwand guided nasal intubation can be used for airway management where a fiberoptic bronchoscope is not always available. In elective surgery where the anesthetist has time to plan for airway management, lightwand can be an easy to use device.

Methodology: Patients of both sexes, ASA physical status I or II, aged between 20 and 50 years, BMI (body mass index) between 18-25, and having mouth opening between 1-4 cm on PAC were included in our feasibility study. Ketofol (ketamine + propofol combination) was used to provide analgesic sedation. Lightwand was inserted into endotracheal tube and tip was bent into J shape before entering nasal cavity. Duration of procedure was calculated as the time between entry of lightwand into nose and starting of $ETCO_2$ waveform on monitor after attaching the breathing circuit. Our study evaluated the lightwand guided nasotracheal intubation, hemodynamic changes and incidence of airway complications in 40 adult non-pregnant patients. Heart rate, systolic, diastolic and mean blood pressures were measured at 0, 1, 2, 5 and 10 min. Statistical analysis was done by using SPSS version 20. Paired T-test was used to compare all the baseline values to different time intervals.

Results: Total time to perform intubation using lightwand was 94.44 ± 27.43 sec in our study. Hemodynamic changes (heart rate, blood pressure) in our study showed a significant increase from baseline values. Eight patients fulfilled our criteria of pain in posterior pharynx on swallowing. An equal number of patients had hoarseness of voice in post op period. In 3 patients nasotracheal intubation could not be done within 5 min (300 sec) and were excluded from the study.

Conclusion: We conclude that lightwand may be used as an option for assisting nasotracheal intubation in patients with limited mouth opening when fiberoptic bronchoscope is not available.

Keywords: Intubation; Difficult airway; Ketamine; *Lighted stylet*, *Lightwand;* Airway management

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INTRODUCTION

Transillumination of the tissues of the neck using a lighted stylet (lightwand) to facilitate intubation was first described by Yamamura *et al* in 1959.[1] Since then, lightwand assisted intubation has been used in patients via oral or nasal route. Lightwand can also be used through the intubating laryngeal mask airway.[2] We decided to use LightWand® lighted stylet (GE healthcare). This device is made up of

a semi-rigid stylet, with a bulb at distal end, and electricity source at proximal end for lighting the bulb. Cost of this stylet is Indian Rs. 3700/- only.

The most important advantage of a lightwand is that it can be used via oral or nasal route to perform intubation in patients having limited mouth opening. In such situations, lightwand provides an alternative to fiberoptic bronchoscopy or blind intubation. The authors aimed to evaluate hemodynamic parameters, duration and complications of lightwand guided nasotracheal intubation.

METHODOLOGY

The authors decided to conduct a feasibility study on the use of lightwand for nasotracheal intubation at LLRM Medical College, Meerut (India) after approval by the college ethics committee from June 2014 to December 2014. Forty patients, ages between 20 and 50 years were recruited, with BMI (body mass index) 18-25. All the patients had limited mouth opening (1-4 cm). Authors did not evaluate the causes of limited mouth opening. Patients unable to cooperate with airway assessment, patients having loose teeth, intra oral infection, cervical spine disease, abnormal upper airway anatomy, and patients undergoing major cardiovascular, thoracic or neurological surgery were excluded from the study. At pre-anesthesia clinic (PAC), written informed consent was obtained from the participants. Thyromental distance (in cm) was measured using a straight ruler at PAC.

After arriving in OR, heart rate, systolic, diastolic and mean arterial pressures, and SpO_2 were recorded. These were taken as baseline values.

0.1% xylometazoline hydrochloride (5 drops) was put in both nostrils. Patient's head was put in neutral position. Inj. glycopyrrolate 0.2 mg (I/M lateral thigh) was given 15 min before starting the procedure. All patients breathed oxygen via face mask (4 lit/min). They were instructed to take deep, slow breathing via mask. This was done to increase FiO_2 to more than 30% while nasal preparation was done. An anesthetist observed respiratory rate on monitor and the range was 14-18 breaths per minute. Patency of the nostrils was assessed by movement of a cotton wick during inspiration and expiration placed at nose opening with one nares closed. After 2 min of oxygenation, ketamine hydrochloride (0.5 mg/kg) and propofol (2 mg/kg) were prepared in a syringe and half (50% of the total) dose was given intravenously as bolus. Unresponsiveness to painful stimuli (pressing on patients' middle finger nail bed) was confirmed before starting insertion of endotracheal tube (ETT) into the nostril. If both nares were found equally patent then right nares was chosen. If any movement was observed of the patient's neck or limbs during procedure, a bolus of 20% of the remaining ketofol was given.

Appropriate sized ETT was inserted till it was in the oral cavity (feeling of sudden loss of resistance). Then, overhead OR lights were switched off. The lightwand was inserted in the ETT till the fixer touched the top of ETT. Guided by light glow showing through the skin of the neck, lightwand was pushed forward, rotated to left or right until the light glow was visible in the midline of the neck just above the cricothyroid membrane. After fixing the lightwand with one hand, the ETT was glided into the trachea with the other hand and lightwand was withdrawn. After connecting the breathing circuit, chest was auscultated and $EtCO_2$ trace was monitored to confirm the position of ETT.

Following parameters were observed during the study; intubation time, HR, MAP, SBP and DBP, at 1, 2, 5 and 10 min after starting the procedure. Zero time was taken as the first recording on the monitor. Complications of the procedure, e.g. hoarseness of voice, pharyngeal pain after extubation and nasal bleeding (epistaxis) during procedure were noted. Epistaxis was defined as bleeding through nose during procedure. Assessment of hoarseness of voice and pharyngeal pain was based on patient's response in postoperative period.

Statistical analysis: Statistical analysis was done by using SPSS version 20. Data is presented as mean ± SD. Significance level was set at $p < 0.5$ while using student's t-test. Hemodynamic changes at different time intervals were compared from baseline to determine statistical significance.

The null hypothesis was that there will be no difference between hemodynamic parameters when using ketofol for lightwand guided nasotracheal intubation. We rejected null hypotheses of no difference if P values were less than 0.05. If $P<0.05$, then it is considered as significant. Repeated measurements for hemodynamic changes are compared by using paired T- test.

RESULTS

Demographic data and airway parameters of the study group are given in Table 1.

Table 1: Patient characteristics andairway parameters of study group (at PAC)

Parameter	Mean ± SD
Male : female	23 : 17
Age (years)	36.64 ± 12.041
Mouth opening (cm)	2.33 ± 0.6614
MP grade	2.16 ± 0.7177
Thyromental distance (cm)	5.28 ± 0.6712

Table 2: Success rate,complications in the study group

Parameter	N(%)
Intubated at first attempt	22(55)
Intubated at second attempt	15(37.5)
Failed intubation	3 (7.5)
Time (sec) (Mean ± SD)	94.44±27.4
Pharyngeal pain	8(22)
Hoarseness of voice	7(19)
Epistaxis	2(5.4)

In 15 patients, we had to take out the lightwand and introduce again due to resistance in pushing at first attempt. In no patient, third attempt for intubation was taken (Table 2).

Twelve patients complained of pain / scratchy feeling in throat. Of these, eight patients fulfilled our criteria of pain in posterior pharynx on swallowing. Seven patients had hoarseness of voice in postop period. All patients recovered to normal voice within 48 hrs. These observations were done 1 hour after patients had an Aldrete score[3] of ≥ 9. An anesthetist not involved in intraoperative management made the observations.

In 3 patients, nasotracheal intubation could not be done and the ketofol dose was completely used up (Table 2).

SpO_2 was kept above 94% in every patient. In no patient SpO_2 fell below 94% during the procedure.

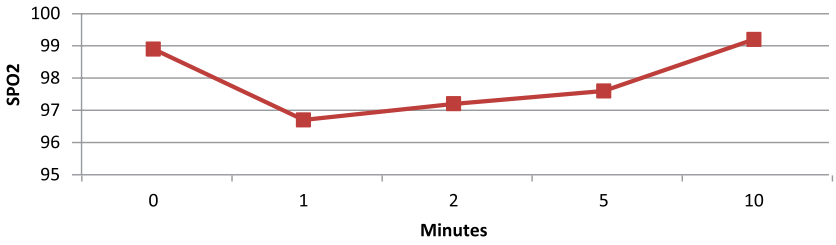

Figure 5: SPO2(mean) at various time intervals.

DISCUSSION

Blind nasal intubation remains the technique for difficult airway management when a fiberoptic bronchoscope is not always available or the anesthetist is not trained in its use. Lightwand has been used in assisted oral intubation, but its use in nasal intubation is not very common. However, it has been shown to be associated with consuming less time than blind intubation in a study done by Y Dong.[4] In addition, the illumination of the lightwand is not influenced by blood or secretions, so the lightwand is perhaps more effective than the fiberoptic bronchoscope in patients with active bleeding in the oral cavity following faciomaxillary trauma as stated by Agrò F.[5] We chose deep sedation with spontaneous breathing to reduce the discomfort for the patients. Frizelle HP[6] used 0.3 mg/kg ketamine for analgesic sedation in adult patients. Authors decided to use 0.5 mg/kg ketamine for this purpose.The approach to give 50% of total ketofol dose as initial bolus was based on author experience. Reduction in dose of these drugs when combined provides advantages of deep sedation, hemodynamic stability and analgesia.

In cases of difficulty during procedure, one or more of the following methods were adopted depending upon clinical assessment;

- external laryngeal manipulation
- extension / flexion of neck to raise the tube tip
- ETT cuff inflation to elevate the ETT tip

Above maneuvers were used in 18 out of 40 patients included in the study. An anesthesiologist with more than two years' experience, assisted in the above maneuvers.The most important principle in lightwand guided nasotracheal intubation is "don't force ETT against resistance". This minimizes trauma and chances of creating false passages are also reduced.

In our study two patients had nasal bleeding during procedure. In one patients, ETT size was judged to be larger for the nares and in rest of the patients, excessive force was applied during nasal insertion of ETT. We used Aquasonic® ultrasound gel (Parker Laboratories, New Jersey, USA) on outer surface of ETT to reduce resistance.

All patients were explained about the risk of hoarseness of voice, dysphagia and sore throat

Table 3: Systolic blood pressure (SBP), at different time-intervals

Time	Mean ± SD	P value	Smallest average difference between pairs at 90% power	Difference between pairs (study)
0 min	124.1±12.115			
1 min	143.90 ± 8.595	<0.05	4.42	19.800
2 min	145.10 ± 9.893	<0.05	4.70	21.000
5 min	139.30 ± 9.262	<0.05	4.77	15.200
10 min	121.20 ± 5.029	>0.05	4.82	2.900

Table 4: Non-invasive mean diastolic blood pressure at various time intervals.

Time	Mean ± SD	P value	Smallest average difference between pairs at 90% power	Difference between pairs (study)
0 min	81.80 ± 5.996			
1 min	93.60 ± 4.971	<0.05	1.96	11.800
2 min	94.2 ± 4.940	<0.05	3.31	12.400
5 min	90.80 ± 2.658	<0.05	3.06	9.000
10 min	77.60 ± 8.208	>0.05	3.66	4.200

P<0.05 is considered as significant

Table 5:Non invasive MAP (mean) at various time intervals.

Time	Mean ± SD	P value	Smallest average difference between pairs at 90% power	Difference between pairs (study)
0 min	96.40 ± 6.415			
1 min	110.1 ± 5.301	<0.05	2.57	13.700
2 min	109.40 ± 4.575	<0.05	3.40	13.000
5 min	107.0 ± 4.422	<0.05	2.76	10.600
10 min	92.1 ± 4.508	<0.05	2.95	4.300

Table 6:Heart rate (mean) at various time intervals

Time	Mean ± SD	P value	Smallest average difference between pairs at 90% power	Difference between pairs (study)
0 min	88.20 ± 6.443			
1 min	99.70 ± 7.484	<0.05	2.40	11.500
2 min	102.1 ± 5.065	<0.05	2.17	13.900
5 min	98.5 ± 3.979	<0.05	2.34	10.300
10 min	80.5 ± 8.423	<0.05	4.42	7.700

in PAC in Hindi language. After the completion of anesthetic recovery (Aldrete score > 9), they were asked about these complications. Friedman PG[7] observed that lightwand intubation may decrease the incidence and severity of postoperative sore throat, hoarseness, and dysphagia in comparison to direct laryngoscopy guided intubation. Xue FS[8] has shown a higher incidence of mild postoperative complications (upto 38%). This could be due to the fact that they used awake lightwand intubation in patients with difficult airway.

Some studies have shown that mallampati score, interincisive distance, and Cormack-Lehane classification of laryngoscopic view has no direct relation with nasotracheal intubation time. Manabe Y[9] in their study observed no relationship between the ease of nasotracheal intubation using TrachLight™ and glottic visualization.

Increase in blood pressure and heart rate could be due to use of ketamine, inadequate anesthesia depth or long duration of procedure. Mechanical stimulation of oral / pharyngeal / laryngeal mucosa can increase sympathetic cardiovascular response. This sympathetic stimulation can increase with duration of stimulation. Reduction in intubation time with gentle manipulation of lightwand could minimize this increase. Sun Y[10] have

shown in their study that increase in blood pressure and heart rate occurs with a blind intubating device used for awake nasotracheal intubation. Takahashi S stated that direct stimulation of the trachea appears to be a major cause of the hemodynamic changes associated with tracheal intubation.[11] The changes are almost the same as that which occur with the direct laryngoscopy.

LIMITATIONS

Limitations of our study include exclusion of pediatric and geriatric age groups. We did not evaluate the learning curve for the device use. Also, based on a study by Chung YT[12], the authors placed patient heads in neutral position and not in sniffing position, so lightwand use in sniffing position was not evaluated. Ketamine-propofol combination provided satisfactory intubating conditions, however, other modalities for awake intubation can be used.

CONCLUSION

Our study shows that lightwand may be used in adult patients with limited mouth opening, where fiberoptic bronchoscopy is not available. Pharyngeal pain, hoarseness of voice and epistaxis were the complications observed in our study.

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Conflict of Interest: None

Author contribution:

SUB: Concept, conduction of study work
VKD: Concept, conduction of study work, manuscript editing
YKM: Concept, conduction of study work
TT: Conduction of study work, Manuscript editing
GS: Statistics, Manuscript editing

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MEMORY

Professor Rustam Ali Nabi – A Pioneer in Anesthesia

Tahoor Manzar

Professor Rustam Ali Nabi was born on 29th September 1916 in a small town Rahon, District Jullundur (now in East Punjab-India). After primary education there, he accompanied his father Mr. Ghulam Nabi to England in 1928 at the age of 12. He joined the Raines Foundation School, Arbour Square London. From there he passed his Matric examination in 1934 and the Intermediate in 1936.

He graduated from St. Bartholomew's in London in 1941. After one year house job at Barking Emergency Hospital, he was conscripted into the Royal Army Medical Corps in 1942. There he volunteered for the Indian Medical Service and was sent to Poona for training in Anesthesiology. He served in Burma, Malaya and Java as an anesthetist till December 1947. As Pakistan had recently been created he was ordered not to join V J Hospital Amritsar as Anesthetist but to proceed straight to KEMC Lahore to join as Asst. Anesthetist. He joined KEMC Lahore in February 1948 and in September 1948 he proceeded to England for postgraduate training in Anesthesia. He qualified the then D.A. (RCP & RCS), Diploma in Anesthesia, the highest qualification in Anesthesia at the time in 1950. He returned to join KEMC. as Asst. Professor and Mayo Hospital and Chief Anesthetist in 1953. He taught at both KEMC and FJMC and trained many postgraduates in the latest techniques of that time.

The first Professorial Chair in Anesthesia was created at KEMC Lahore in 1959 and Prof. Rustam Ali Nabi became the first Professor of Anesthesia in Pakistan. In 1962 FFARCS (Eng), now called FRCA i.e. Fellow of the Royal College of Anesthetists, was conferred upon him. He conducted the first D.A. examination for the University of Punjab in 1962. He was also an examiner for the MCPS & FCPS for the College of Physicians and Surgeons of Pakistan. In 1974, as the age of retirement was 58 at that time, he retired from government service. He was offered a 3 year extension and the role of Principal of Nishtar Medical College, both of which he refused gracefully.

Throughout his career, he was sought out not only for professional advice and expertise but also for guidance in planning careers, personal lives and dealing with in fact anything that presented a problem. Therefore he came to be known as Guru Ji – the soft-spoken, doe-eyed sage who was available to all and at all times. Many remember him as the kind administering gentle doctor who drove away all fears, the troubleshooting anesthetist who would sit up all night, smoking and pondering over the solution to a patient's problem or as the learned colleague with a twinkle in his eyes and a great sense of humour. He was at peace with himself in this very world and the contentment he had is seldom seen these days.

He helped set up the Anesthesia Units of Fatima Memorial Hospital, Mansab Clinic, Imtiaz Surgical Clinic, Rehmatullah Trust Hospital and many others. Some of our very senior anesthesiologists were mentored by him such as Prof. Attia Sakhi, Brig. Saleem, Prof. Mehdi Hassan Mumtaz, Prof. Manzoor Chaudhry, Dr. Munir Ahmad (late) and others. He introduced and taught Spinal Analgesia to them. He was also the first to successfully practice treatment of Trigeminal Neuralgia by injecting alcohol into the Gasserian Ganglion. He generously imparted to others all that he had learned abroad and also kept current with the latest knowledge as long as he lived. He passed away on the 28th of November 1993.

Some of his favourite sayings:
"Necessity is the mother of invention and laziness is the step-mother of invention"
"Always listen carefully to your patient or you may miss out on something important"
"Anything worth doing is worth doing well"
"Ik motapa, sau siyapa"