Lightwand-guided Endotracheal Intubation Performed by the Nondominant Hand is Feasible

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The aim of this study was to evaluate the efficiency of lightwand-guided endotracheal intubation (LWEI) performed using either the right (dominant) or left (nondominant) hand. Two hundred and forty patients aged 21–64 years, with a Mallampati airway classification grade of I–II and undergoing endotracheal intubation under general anesthesia, were enrolled in this randomized and controlled study. Induction of anesthesia was initiated by intravenous administration of fentanyl (2 μg/kg) and thiopentone (5 mg/kg), and tracheal intubation was facilitated by intravenous atracurium (0.5 mg/kg). In the direct-vision laryngoscope group (group D; $n=80$), the intubator held the laryngoscope in the left hand and inserted the endotracheal tube (ETT) into the glottic opening with the right hand. In the group in which LWEI was performed with the right hand (group R; $n=80$), the intubator lifted the patients' jaws with the left hand and inserted the ETT-LW unit into the glottic openings with the right hand. On the contrary, in the group in which LWEI was performed with the left hand (group L; $n=80$), the intubator lifted the jaws with the right hand and inserted the ETT-LW unit with the left hand. Data including total intubation time, the number of intubation attempts, hemodynamic changes during intubation, and side effects following intubation, were collected. Regardless of whether lightwand manipulation was performed with the left hand (group L; 11.4 ± 9.3 s) or the right-hand (group R; 12.4 ± 9.2 s), less time was consumed in the LWEI groups than in the laryngoscope group (group D; 17.9 ± 9.9 s) ($p<0.001$). All three groups obtained success rates > 95% on their first intubation attempts. The changes in mean arterial blood pressure and heart rate were similar among the three groups. A higher incidence of intubation-related oral injury and ventricular premature contractions (VPC) was found in group D compared with groups L and R (oral injury: group D 8.5%, group L 1.3%, group R 0%, $p=0.005$; VPC: group D 16.3%, group L 5%, group R 7.5%, $p=0.04$). We concluded that LWEI performed by either dominant or nondominant hands resulted in similar efficiency, and could be a suitable alternative to traditional laryngoscopy. It is both feasible and logical for an experienced anesthesiologist to use the nondominant hand to perform LWEI.

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Although direct-vision laryngoscopy remains the standard method of tracheal intubation, several alternative techniques have been used to establish the airway in the operating room, intensive care unit and emergency department. Among these, the use of a lightwand or illuminated stylet to provide guidance for endotracheal intubation has been proved to be effective, simple and safe [1,2].

When performing lightwand-guided endotracheal intubation (LWEI), the intubator would usually hold the handle of the wand and manipulate the lightwand-tube assembly with his/her right hand (dominant hand), while lifting patients' jaws with the left hand (nondominant hand). However, severe left facial injury, hypermobility of teeth in the left lower jaw, and ulcers or tumors in the left perioral region may interfere with the operation of the left hand to lift the jaw. In such situations, the intubator can use his/her left hand to lift the jaw and hold the handle of the wand in the right hand for intubation. It has been demonstrated that inverse intubation, using the right hand to hold the laryngoscope and passing the endotracheal tube (ETT) with the left hand, is feasible [3]. Is it feasible for an intubator to perform LWEI with the nondominant hand? The aim of this study was to investigate the efficiency of performing LWEI with the dominant or nondominant hand and to compare these methods with the technique of conventional laryngoscope intubation, in order to answer this question.

Materials and Methods

The protocol was approved by the Kaohsiung Medical University ethics committee for human investigation, and informed consent was obtained from each patient. Two hundred and forty patients with an American Society of Anesthesiology (ASA) physical status of I–II and a Mallampati airway classification grade of I–II, aged 21–64 years old, who had to undergo orthopedic or plastic surgery and general anesthesia necessitating the use of endotracheal intubation, were enrolled in a randomized, controlled study (a randomization table was used to assign patients to one of the three groups). Right-handed anesthesiologists who were skilled in performing lightwand-guided intubation and who had performed at least 10 lightwand-guided intubations with the left (nondominant) hand performed the intubations for this study [4]. Before starting, the investigator evaluated each patient for eligibility to participate in the study, using a predefined list of exclusion criteria: history of difficult intubation, upper airway tumors or polyps, coronary artery disease, cerebrovascular abnormalities, and intraoral or upper airway surgery.

All patients were required to fast for ≥ 8 hours; they were given no premedication before operation. On arrival in the operating room, the investigator monitored the patient's heart rate (HR) with ECG lead II and blood pressure (BP) with a noninvasive pressure cuff (of the proper size) on his/her left or right arm (Viridia 24C, M1205A; Hewlett Packard, Andover, MA, USA). Induction of anesthesia was initiated by intravenous fentanyl (2 μg/kg) and thiopentone (5 mg/kg), and tracheal intubation was facilitated by intravenous administration of atracurium (0.5 mg/kg) and 100% O_2 oxygenation via a mask for 3 minutes. To maintain a stable depth of anesthesia, inhalation isoflurane was administered and the end tidal isoflurane concentration was kept around 2–2.5% during the study period. The end tidal CO_2 concentration was maintained in the range of 35 to 40 mmHg, with adjustment to respiratory frequency of approximately 8–12 times per minute, and the tidal volume of 10–12 mL per kilogram was maintained during the study period.

In group D, 80 patients received conventional intubation with direct-vision laryngoscopy by holding the laryngoscope handle in the left hand. Patients lay supinely and had neck flexion and head extension maintained with a pillow. The intubator inserted a Macintosh No. 3 standard curved blade into the patient's mouth, lifted the epiglottis, and introduced the ETT into the glottic opening. If the glottic opening was poorly visible during this intubation, another assigned anesthetist, recruited to assist, exposed the glottis using the BURP (backward, upward and rightward pressure on the thyroid cartilage) maneuver. Those patients receiving lightwand-guided tracheal intubations were supine and their necks and heads were maintained in a neutral position. The distal end of the ETT-enclosed lightwand was shaped in a "hockey stick" configuration, which placed the light bulb close to, but not protruding beyond, the tip of the ETT. The light of the operating room was dimmed, and then the lightwand was switched on in order for lightwand-guided intubation to be performed with the right hand (group R, $n = 80$); the epiglottis was raised with the left hand using a simple jaw lift, and the LW-ETT unit was inserted into the glottic opening using the right hand. To perform lightwand-guided intubation with the left hand (group L, $n = 80$), the intubation procedures were the same as those performed on group R except that the jaw was lifted with the right hand and the LW-ETT unit inserted into the trachea with the left hand.

Three intubation attempts were allowed in each patient. Intubation failure was defined as the inability to place the ETT correctly, or going beyond 30 seconds on each intubation attempt. After failed attempts, a classic laryngeal mask was inserted to maintain airway patency. Each intubation time was counted as follows. The timing in group D started from Macintosh blade insertion and placement of the ETT, finishing with the connection of the respiration system. The timing in groups R and L started from the insertion of the intubation unit into the oral cavity and removal of the wand from the tracheal tube following correct placement of the ETT, finishing with the connection of the respiration system. The total intubation time was defined as the sum of the durations of all intubation attempts. Following successful intubation, but prior to the beginning of surgery, the oropharynx was examined by another anesthesiologist for evidence of complications, such as oral mucosal bleeding, lacerations or dental injury.

Mean arterial blood pressure (MAP) and HR were measured and collected by a BP monitor at each of the following checkpoints: before anesthetic induction (BA), immediately after tracheal intubation (T_0), 1 minute after tracheal intubation (T_1), 3 minutes after tracheal intubation (T_3), and 5 minutes after tracheal intubation (T_5), respectively. Investigators used a stopwatch to measure the intubation time taken and each time interval.

At the end of surgery and anesthesia, the ETT was removed using routine extubation criteria [5]. Perioperative side effects and complications were recorded. In addition, the morning after intubation, patients were given a questionnaire by a medical staff member, who was blind to the intubation procedures, on the dryness of mouth, sore throat and hoarseness.

Spearman's rank-order correlation was conducted to evaluate the association between the Mallampati classification and the number of intubation attempts. The time spent on intubation and the number of successful attempts in the three groups was tested by one-way ANOVA and *post hoc* tests. The side effects and complications among the groups were compared using the χ^2 or Fisher's exact test. During the peri-intubation period, MAP and HR measurements among the three groups were compared using repeated measures ANOVA.

Results

There was no significant difference among groups in terms of age, gender distribution, body weight, height, or presenting diseases requiring an operation (Table 1).

The Mallampati scores of all three groups were similar. When the number of intubation attempts and Mallampati classification were compared among groups, Spearman's rank correlation (ρ) was 0.1 for group D, 0.3 for group L and 0.1 for group R, indicating no strong association between this classification and the number of intubation attempts.

The intubation time spent on group D (17.9 ± 9.9 s) was significantly different from that spent on group L (11.4 ± 9.3 s) or on group R (12.4 ± 9.2 s) ($p < 0.001$). However, the lightwand-guided intubation times spent on groups L and R were not significantly different ($p = 0.47$). Although two patients in group D, two patients in group L, and three patients in group R required

Table 1. Demographic characteristics of the three groups*†

	Group D ($n = 80$)	Group L ($n = 80$)	Group R ($n = 80$)
Age (yr)	42.5 ± 13.8	40.8 ± 13.8	44.2 ± 14.8
Female/male	48/32	53/27	48/32
Weight (kg)	63.4 ± 12.1	60.7 ± 12.1	61.3 ± 10.7
Height (cm)	161.9 ± 7.3	161.7 ± 7.7	161.3 ± 7.2
Surgical type			
General surgery	45	41	40
Orthopedic surgery	22	17	28
Plastic surgery	13	22	12

*Data are presented as mean ± standard deviation or *n*; †there was no statistical significance among groups. Group D = intubation with a direct-vision laryngoscope; Group L = lightwand-guided endotracheal intubation with the left hand; Group R = lightwand-guided endotracheal intubation with the right hand.

a second intubation attempt, no one failed to be intubated in this study (Table 2). Twelve patients needed another anesthetist to improve the visualization of the glottic aperture using the conventional intubation technique, and no assistance was required while using LWEI to establish the airway.

Measurement of hemodynamic changes during the perioperative period revealed a similar MAP and HR trend among the three groups. Comparing baseline hemodynamic changes with those at each checkpoint, within each group, the MAP and HR values were significantly increased at T_0 ($p<0.001$) and T_1 ($p<0.001$), respectively. Comparing baseline hemodynamic changes with those at each checkpoint, within each group, the MAP value increased rapidly in the time interval from T_0 to T_1, gradually declined to a comparable range at T_3, and decreased at T_5. A significant difference was shown between the checkpoints of BA *vs.* T_0 ($p<0.001$) and BA *vs.* T_1 ($p<0.001$) (Table 3). The HR trend was similar to the trend of MAP, and a significant difference was shown between the checkpoints of BA *vs.* T_0 ($p<0.001$) and BA *vs.* T_1 ($p<0.001$) (Table 3). An analysis of side effects and complications showed a similar incidence in the severity of sore throat, dryness of mouth and hoarseness (Table 4). A higher incidence of intubation-related oral mucosa injury and ventricular premature contractions (VPC) was found in group D than in groups L and R (oral injury: group D 8.5% *vs.* group L 1.3% *vs.* group R 0%, $p=0.005$; VPC: group D 16.3% *vs.* group L 5% *vs.* group R 7.5%, $p=0.04$).

Discussion

Most researchers are in favor of LWEI, because this method requires less time than intubation with laryngoscopy [6–9]. However, Kihara et al reported that intubation using a lightwand-guided technique took more time to establish the airway than the traditional

Table 2. Success rates and duration of intubation in the three groups*

	Group D ($n=80$)	Group L ($n=80$)	Group R ($n=80$)
Mallampati classification			
Grade 1/2/3/4	31/39/10/0	33/35/11/1	26/48/4/2
Intubation time (s)	17.9 ± 9.9†	11.4 ± 9.3†	12.4 ± 9.2†
Intubation			
Success at 1st attempt	78 (97.5)	78 (97.5)	77 (96.3)
Success at 2nd attempt	2 (2.5)	2 (2.5)	3 (3.8)
Success at 3rd attempt	0	0	0

*Data are presented as mean ± standard deviation or *n* (%); †Group D required longer intubation time than groups L and R ($p<0.001$), but there was no significant difference between groups L and R ($p=0.47$), *p* value by one-way ANOVA and *post hoc* test.

Table 3. Mean arterial blood pressure (MAP) and heart rate (HR) measurements during the peri-intubation period*

	Time interval				
	BA	T_0	T_1	T_3	T_5
MAP (mmHg)					
Group D	85.4 ± 12.1	110.0 ± 15.4†	100.9 ± 14.6†	88.4 ± 13.4	78.4 ± 12.1
Group L	88.9 ± 12.3	112.2 ± 14.5†	100.5 ± 12.6†	88.4 ± 12.2	79.1 ± 13.0
Group R	86.8 ± 12.8	114.1 ± 16.0†	103.4 ± 14.9†	90.8 ± 14.0	81.6 ± 12.1
HR (beats/min)					
Group D	86.3 ± 14.8	105.6 ± 17.3†	98.6 ± 11.6†	86.8 ± 8.9	81.0 ± 8.2
Group L	86.1 ± 17.2	108.3 ± 18.2†	97.9 ± 12.4†	87.3 ± 10.5	80.5 ± 9.9
Group R	81.3 ± 15.5	108.5 ± 17.7†	100.3 ± 12.1†	84.7 ± 8.5	78.2 ± 7.3

*Data are presented as mean ± standard deviation; †there was no statistical significance in MAP and HR changes when the three groups were compared in the same time interval. However, comparing baseline hemodynamic changes with the other time intervals by using repeated measures ANOVA within each group revealed that the MAP and HR values increased significantly at the T_0 ($p<0.001$) and T_1 time intervals ($p<0.001$), respectively. BA = before anesthesia induction; T_0 = immediately after tracheal intubation; T_1 = 1 minute after tracheal intubation; T_3 = 3 minutes after tracheal intubation; T_5 = 5 minutes after tracheal intubation.

Table 4. Side effects and complications in the three groups*

	Group D ($n = 80$)	Group L ($n = 80$)	Group R ($n = 80$)
Sore throat			
None	56 (70.0)	47 (58.75)	50 (62.5)
Mild pain	23 (28.75)	32 (40.0)	27 (33.75)
Pain on swallowing	1 (1.25)	2 (2.5)	3 (3.75)
Pain on swallowing and respiration	0	0	0
Cough with sputum	12 (15.0)	13 (16.3)	8 (10.0)
Dryness of mouth	14 (17.5)	13 (16.3)	12 (15.0)
Hoarseness	22 (27.5)	13 (16.3)	12 (15.0)
Oral mucosal or lip injury	7 (8.5)†	1 (1.25)†	0†
Dental injury	2 (2.5)	0	0
Vomiting	14 (17.5)	17 (21.3)	9 (11.3)
Dysrhythmia			
Ventricle premature contraction	13 (16.3)‡	4 (5.0)‡	6 (7.5)‡

*Data are presented as n (%); †Group D *vs.* Groups L and R ($p = 0.005 < 0.01$), Fisher's exact test; ‡Group D *vs.* Groups L and R ($p = 0.04 < 0.05$), χ^2 test.

laryngoscopy technique [10]. Factors such as small sample sizes and different ways of measuring intubation time may have affected the results of these studies. According to the data of intubation time from Hung et al, comparing the technique of lightwand with laryngoscopy, at least 79 patients should be included in each group in order to have sufficient statistical power, in accordance with the power analysis > 0.8 [1]. In this study, for a more logical and clearer view for analysis, the investigators adjusted the protocol to enroll more patients with normal anatomic situations, and assistance was allowed, as needed, during intubation. We found that both conventional intubation and lightwand-guided intubation resulted in a short intubation time in clinical practice. However, there was a significant time-saving effect of using LWEI to establish airway under general anesthesia compared with conventional direct-vision laryngoscopy intubation. Therefore, using lightwand-guided intubation should be recommended for patients with a blurred intraoral visual field, and when fast airway establishment is needed.

Although an intubator habitually uses the dominant hand to manipulate lightwand assembly, this study demonstrated that it is feasible to perform LWEI with either the dominant or the nondominant hand. Kageyama et al demonstrated that junior ophthalmologists can effectively perform temporal incision phacoemulsification with the nondominant left hand, and that the use of the nondominant versus the dominant hand does not increase the incidence of complications during surgery [11]. Orbak et al reported that dentists remove tooth calculus more efficiently with left hands than right hands [12]. In the present study, performing LWEI with either the dominant hand or the nondominant hand resulted in a similar efficiency. A report on intermanual transfer of learning or cross-education by Andree and Maitra demonstrated that the activities learned by using one hand facilitate the performance of those activities by the other hand, and that the transfer of learning does not depend on hand dominance [13]. Transfer of learning may explain why expert intubators also obtained good efficiency when using their nondominant hands.

The cardiovascular responses to LWEI or direct laryngoscopic endotracheal intubation were similar and increased significantly in the first minute [7,14]. Nevertheless, Kihara et al, using lidocaine, propofol, vecuronium, sevoflurane and nitrous oxide to induce anesthesia in patients, observed that in hypertensive (but not normotensive) anesthetized paralyzed patients, the lightwand (but not the Macintosh laryngoscope) reduced the hemodynamic stress response to tracheal intubation [10]. Although we did not demonstrate such a difference in the hemodynamic responses among groups, the obviously higher incidence of transient VPC in group D indicated a difference between the lightwand-guided technique and direct-vision laryngoscopy. Further investigations should be conducted to explore the reasons for this difference.

The Mallampati classification alone cannot provide anesthesiologists with a reliable means of determining which patients will be difficult to intubate; a similar situation was found with the LWEI technique, given the low correlation between the number of intubation attempts and the Mallampati scores [2]. Still, in the present study, five patients with Mallampati grades of I–II required second attempts in order for the airway to be established using LWEI. To improve the success rate of lightwand-guided intubations, the length of the bend in the wand may be matched to a patient's thyroid prominence-to-mandibular angle, and the lightwand may be bent to 40–60 degrees, with the extrusion of 1–2 cm from the tracheal tube [15,16].

In summary, regardless of the use of dominant or nondominant hand, LWEI obtains similar efficiency and is a logical alternative to traditional laryngoscopy. It is feasible for an experienced anesthesiologist to insert the LWEI with the nondominant hand. Thus, performing LWEI with the nondominant hand should be considered when necessary.

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References

1. Hung OR, Pytka S, Morris I, et al. Clinical trial of a new lightwand device (Trachlight) to intubate the trachea. *Anesthesiology* 1995;83:509–14.
2. Hung OR, Pytka S, Morris I, et al. Lightwand intubation: II—Clinical trial of a new lightwand for tracheal intubation in patients with difficult airways. *Can J Anaesth* 1995;42:826–30.
3. Robinson K, Donaghy K, Katz R. Inverse intubation in air medical transport. *Air Med J* 2004;23:40–3.
4. Langeron O, Lenfant F, Aubrun F, et al. Assessment of a new light guide (Trachlight) for tracheal intubation. *Ann Fr Anesth Reanim* 1997;16:229–33. [In French]
5. Stone DJ, Gal TJ. Airway management. In: Miller RD, ed. *Anesthesia*, 5th edition. New York: Churchill Livingstone, 2000:1414–48.
6. Kanaide M, Fukusaki M, Tamura S, et al. Hemodynamic and catecholamine responses during tracheal intubation using a lightwand device (Trachlight) in elderly patients with hypertension. *J Anesth* 2003;17:161–5.
7. Takahashi S, Mizutani T, Miyabe M, Toyooka H. Hemodynamic responses to tracheal intubation with laryngoscope versus lightwand intubating device (Trachlight) in adults with normal airway. *Anesth Analg* 2002;95: 480–4.
8. Nishikawa K, Kawana S, Namiki A. Comparison of the lightwand technique with direct laryngoscopy for awake endotracheal intubation in emergency cases. *J Clin Anesth* 2001;13:259–63.
9. Nishikawa K, Omote K, Kawana S, Namiki A. A comparison of hemodynamic changes after endotracheal intubation by using the lightwand device and the laryngoscope in normotensive and hypertensive patients. *Anesth Analg* 2000;90:1203–7.
10. Kihara S, Brimacombe J, Yaguchi Y, et al. Hemodynamic responses among three tracheal intubation devices in normotensive and hypertensive patients. *Anesth Analg* 2003;96:890–5.
11. Kageyama T, Yaguchi S, Metori Y, et al. Visual results and complications of temporal incision phacoemulsification performed with the non-dominant left hand by junior ophthalmologists. *Br J Ophthalmol* 2002;86: 1222–4.
12. Orbak R, Tezel A, Canakci V, Tan U. Right- and left-handed dentists using right- and left-sided dental chairs in treatment of calculus. *Int J Neurosci* 2002;112:15–30.
13. Andree ME, Maitra KK. Intermanual transfer of a new writing occupation in young adults without disability. *Occup Ther Int* 2002;9:41–56.
14. Hirabayashi Y, Hiruta M, Kawakami T, et al. Effects of lightwand (Trachlight) compared with direct laryngoscopy on circulatory responses to tracheal intubation. *Br J Anaesth* 1998;81:253–5.
15. Nishiyama T, Matsukawa T, Hanaoka K. Optimal length and angle of a new lightwand device (Trachlight). *J Clin Anesth* 1999;11:332–5.
16. Chen TH, Tsai SK, Lin CJ, et al. Does the suggested lightwand bent length fit every patient? The relation between bent length and patient's thyroid prominence-to-mandibular angle distance. *Anesthesiology* 2003;98: 1070–6.

非慣用手 Lightwand 協助氣管插管使用是可行的

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此次研究目的為探討使用右手 (慣用手) 或者左手 (非慣用手) 來操作 lightwand 協助氣管插管 (LWEI) 的功效。此隨機對照實驗收錄經氣管內管進行全身麻醉的 240 位病人。麻醉誘導為靜脈注射 fentanyl 2 μg/kg 和 thiopentone 5 mg/kg，且以 atracurium 0.5 mg/kg 輔助氣管內管插管。使用傳統喉頭鏡氣管插管組 (D 組，80 人)，操作者使用左手固定喉頭鏡並使用右手置放氣管內管；右手使用 lightwand 協助氣管插管組 (R 組，80 人)，操作者使用左手提起下顎並使用右手執 lightwand 置放氣管內管；左手使用 lightwand 協助氣管插管組 (L 組，80 人)，操作者使用右手提起下顎並使用左手執 lightwand 置放氣管內管。記錄各組氣管插管發時間、氣管插管次數、插管期間血液動力學的變化、及插管後副作用的發生。我們發現使用 LWEI 的組別在操作時間上比傳統喉頭鏡氣管插管的組別時間較短 (Group L *vs.* R *vs.* D；11.4 ± 9.3 s *vs.* 12.4 ± 9.2 s *vs.* 17.9 ± 9.9 s，$p < 0.001$)。三個組別於第一次置放氣管內管成功率都高達 95% 以上並且在操作期間之平均動脈壓及心跳變化上個組別間並無明顯差異。組別 D 的插管造成口腔組織受傷及心室心律不整的機率較組別 L 及組別 R 高 (口腔組織受傷，Group D 8.5% *vs.* L 1.3% *vs.* R 0%，$p = 0.005$；VPC，Group D 16.3% *vs.* L 5% *vs.* R 7.5%，$p = 0.04$)。以非慣用手或慣用手進行 LWEI 得到相似的功效且為傳統喉頭鏡氣管插管之外合適可供選擇的方式。對於有經驗的麻醉醫師，以非慣用手操作 LWEI 是可行的。

關鍵詞：氣管內管，lightwand，非慣用手
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