Hemodynamic and catecholamine responses during tracheal intubation using a lightwand device (Trachlight) in elderly patients with hypertension

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Abstract
Purpose. Tracheal intubation using a lightwand device (Trachlight) should minimize hemodynamic change by avoiding direct-vision laryngoscopy. We evaluated hemodynamic and catecholamine responses during tracheal intubation using a Trachlight in elderly patients with hypertension.

Methods. Twenty-six hypertensive patients aged over 65 years undergoing orthopedic surgery were randomly divided into two groups, group L (n = 13) and group T (n = 13). Anesthesia was induced with fentanyl (2 µg·kg⁻¹) and propofol (1.5 mg·kg⁻¹), and then muscle relaxation was obtained with vecuronium (0.15 mg·kg⁻¹). The trachea was intubated with either a Macintosh laryngoscope (group L) or a Trachlight (group T). Hemodynamics, plasma catecholamine concentrations, and arterial blood gases were measured before the induction of anesthesia (T0), before tracheal intubation (T1), immediately after tracheal intubation (T2), and 3 min after tracheal intubation (T3).

Results. The intubation time was shorter in group T than in group L (12.6 ± 1.7 vs 23.5 ± 2.9 s, mean ± SE; P < 0.01). Compared with the preinduction (T0) value, systolic blood pressure (SBP) showed a significant decrease at T1 and T3 in group L and at T1, T2, and T3 in group T. The heart rate (HR) and plasma norepinephrine (NE) concentration showed no change in either group throughout the time course, whereas the plasma epinephrine (E) concentration showed a significant decrease at T2 and T3 in both groups. The mean values of the rate-pressure product (RPP: HR × SBP) were less than 15 000 after tracheal intubation in both groups. There was no significant difference in hemodynamic or catecholamine responses between groups at any point. No patient had ischemic ST-T changes in either group.

Conclusion. A lightwand has no advantage over a laryngoscope in terms of hemodynamic and plasma catecholamine responses to tracheal intubation in elderly patients with hypertension, despite a shorter intubation time.

Key words Tracheal intubation · Anesthetic techniques · Lightwand · Hemodynamics · Catecholamine · Hypertension

Introduction
Tracheal intubation with a laryngoscope increases arterial blood pressure (ABP) and heart rate (HR), which might increase the risk of myocardial infarction or stroke in elderly patients with hypertension. These hemodynamic changes are caused by increased activity of the sympathetic nervous system [1–3].

Attenuation of hemodynamic changes following tracheal intubation with a lightwand device may be attributed to the lack of stimulation by a laryngoscope [4–6]. However, there is a controversy as to whether the lightwand technique significantly attenuates hemodynamic changes after tracheal intubation in comparison with the laryngoscopic technique in normotensive and hypertensive patients [6,7]. Similarly, a lightwand technique may be useful for tracheal intubation in hypertensive elderly patients in terms of the rate-pressure product [8].

We compared the hemodynamic and plasma catecholamine responses with the use of a lightwand device (Trachlight, Laerdal Medical, Fukuoka, Japan) and a laryngoscope in elderly patients with hypertension.

Materials and methods
The protocol of the study was approved by the Institutional Ethics Committee. Informed consent was obtained from each patient. Twenty-six hypertensive patients, aged over 65 years, undergoing orthopedic surgery were divided into two groups by a sealed envelope technique, group L (n = 13) and group T (n = 13), to receive tracheal intubation using either a Macintosh laryngoscope (group L) or a Trachlight (group T). Pa-
tients with cardiopulmonary disease, cerebrovascular disease, a history of previous difficult intubation, cervical spine fracture, tumors or polyps in the upper airway, or medication with β-adrenergic blockers were excluded from the study. Hypertension was defined as a systolic blood pressure (SBP) of more than 160 mmHg or a diastolic blood pressure (DBP) of more than 95 mmHg on admission. All patients were treated by physicians with oral antihypertensive drugs, including calcium-channel blockers and angiotensin-converting enzyme inhibitors (ACEIs).

The patients received their antihypertensive drugs 6 h before the induction of anesthesia and were premedicated with atropine 0.5 mg and hydroxyzine 25 mg intramuscularly 30 min before the induction of anesthesia. After arrival at the operating room, an intravenous catheter was inserted for the administration of intravenous fluids and injection. Patients were continuously monitored with pulse oximetry and a three-lead electrocardiogram. A radial arterial catheter was inserted for continuous monitoring of ABP and to obtain blood samples. ABP, HR, ischemic ST-T change, and arrhythmias were automatically recorded (BSM-8500, Life Scope 12, Nihon Kohden, Tokyo, Japan). Each patient was preoxygenized by inhalation of 100% oxygen before the induction of anesthesia and were premedicated with atropine 0.5 mg and hydroxyzine 25 mg intramuscularly 30 min before the induction of anesthesia. After arrival at the operating room, an intravenous catheter was inserted for the administration of intravenous fluids and injection. Patients were continuously monitored with pulse oximetry and a three-lead electrocardiogram. A radial arterial catheter was inserted for continuous monitoring of ABP and to obtain blood samples. ABP, HR, ischemic ST-T change, and arrhythmias were automatically recorded (BSM-8500, Life Scope 12, Nihon Kohden, Tokyo, Japan). Each patient was preoxygenized by inhalation of 100% oxygen at a flow rate of 51· min⁻¹ for 5 min. Anesthesia was induced with intravenous fentanyl 2 µg·kg⁻¹, lidocaine 20 mg, and propofol 1.5 mg·kg⁻¹ in sequence. Vecuronium 0.15 mg·kg⁻¹ was given after loss of consciousness, and then the lungs were manually ventilated via a mask with 100% oxygen.

Tracheal intubation was performed 5 min after the induction of anesthesia, and manual ventilation with 100% oxygen was continued until the end of the study. End-tidal carbon dioxide tension was maintained at 35 torr and 100% oxygen was continued until the end of the study. The intubation time was defined as the time from the introduction of the device into the oral cavity until its removal. SBP and HR were measured and arterial blood gases were analyzed (ABL-4, Radiometer, Copenhagen, Denmark) before the induction of anesthesia (T0), before tracheal intubation (T1), immediately after tracheal intubation (T2), and 3 min after tracheal intubation (T3). RPP (HR × RPP) was calculated as an index of myocardial oxygen consumption at T0, T1, T2, and T3. Serum catecholamine [epinephrine (E) and norepinephrine (NE)] concentrations were measured at T0, T2, and T3 as follows. A 3-ml blood sample was withdrawn into a precooled plastic tube containing 30 µl of 0.2 M ethylenediaminetetraacetic acid-2Na and 0.2 M Na₂S₂O₄ and was centrifuged at 4000 rpm for 10 min at 4°C to separate the plasma. To the 1 ml of plasma, 33 µl of 60% perchloric acid was added, and the mixture was centrifuged at 10 000 g for 30 min at 4°C. The amount of dopamine in 500 µl of the deproteinized plasma was determined in a fully automated high-performance liquid chromatography-fluorometric system (model HLC-8030 Catecholamine Analyzer, Tosoh, Tokyo, Japan) using a diphenylethylene diamine condensation method [9]. The interassay and intraassay variations were less than 3%. Tracheal intubation on each patient was performed by the same experienced anesthesiologist.

The data are expressed as means ± SEM. Student’s t-test for unpaired data was used for statistical analysis of the differences between the two groups. Differences among repeated measures were analyzed by analysis of variance and Scheffé’s F test. P < 0.05 was considered to indicate statistical significance.

### Results

The two groups were similar in demographic characteristics. The intubation time was shorter in group T than in group L (P < 0.01, Table 1). There was no hypoxemia or hypercapnia in either group throughout the study (Table 2).

SBP showed a significant decrease at T1 and T3 in group L, whereas it showed a significant decrease at T1, T2, and T3 in group T. HR showed no change in either group throughout the time course. RPP showed a significant decrease at T1 and T3 in group L, whereas it showed a significant decrease at T1 in group T (Fig. 1). Plasma E concentration showed a significant decrease at T2 and T3 in both groups, whereas plasma NE concentration showed no change in either group throughout the time

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<th>Table 1. Patient characteristics</th>
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Values are expressed as means ± SE
* P < 0.01 vs group L