Use of the fiberoptic stylet scope (Styletscope™) reduces the hemodynamic response to intubation in normotensive and hypertensive patients

[L'utilisation d'un stylet fibroscopique (Styletscope™) réduit la réponse

hémodynamique à l'intubation chez les patients normotendus et hypertendus]

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Purpose: To compare hemodynamic changes after tracheal intubation when using a new fiberoptic stylet scope (Styletscope™) and a conventional laryngoscope in normotensive and hypertensive patients.

Methods: Normotensive (N; n=30) and hypertensive (H; n=30) patients undergoing general anesthesia participated in this study. Each group was divided into two groups. In one group, patients were intubated by using a stylet scope with a laryngoscope as an adjuvant (S; n=15 each), while patients in the other group were intubated using a laryngoscope by the usual technique (L; n=15 each). The time necessary for intubation, hemodynamic changes, and adverse effects were recorded.

Results: Patients in the normotensive groups (SN and LN groups) showed significant increases in both systolic and diastolic blood pressures from before induction to one minute after intubation; however, blood pressures in the SN group were significantly lower than those in the LN group. Both systolic and diastolic blood pressures increased after intubation in the LH group, but not in the SH group. Heart rates in all four groups showed significant increases, and there were no differences between heart rates in the stylet scope and laryngoscope groups or between the normotensive and hypertensive groups. The number of patients who complained of sore throat was greater in the laryngoscope groups.

Conclusions: Tracheal intubation with a stylet scope can attenuate hemodynamic changes and reduce the incidence of sore throat in comparison with the conventional laryngoscope technique in both normotensive and hypertensive patients.

Objectif : Comparer les modifications hémodynamiques provoquées par l'intubation endotrachéale réalisée avec un nouveau stylet fibroscopique (Styletscope™) ou un laryngoscope traditionnel chez des patients normotendus ou hypertendus.

Méthode : Des patients normotendus (N ; n = 30) ou hypertendus (H ; n = 30), devant subir une anesthésie générale, ont participé à l'étude. Chaque groupe a été divisé en deux sous-groupes. Dans l'un des groupes, l'intubation a été réalisée avec le stylet et un laryngoscope comme auxiliaire (S ; n = 15 chacun) et dans l'autre groupe, avec un laryngoscope selon la technique habituelle (L ; n = 15 chacun). Le temps nécessaire à l'intubation, les modifications hémodynamiques et les effets secondaires ont été enregistrés.

Résultats : Les patients des groupes de normotendus (groupes SN et LN) ont subi une élévation significative des tensions artérielles systolique et diastolique, de la période qui précède l'induction jusqu'à une minute après l'intubation ; toutefois, les tensions artérielles du groupe SN ont été significativement plus basses que celles du groupe LN. Les tensions systolique et diastolique ont augmenté après l'intubation chez les patients du groupe LH, mais non chez ceux du groupe SH. Chez tous les patients, les fréquences cardiaques se sont significativement élevées et aucune différence intergroupe n'a été affichée. Le nombre de patients qui ont éprouvé un mal de gorge a été plus important avec l'usage du laryngoscope.

Conclusion : L'intubation endotrachéale avec un stylet fibroscopique, comparée à la technique laryngoscopique traditionnelle, peut diminuer les changements hémodynamiques et réduire l'incidence de mal de gorge, et ce, autant chez les patients normotendus qu'hypertendus.

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CONVENTIONALLY, tracheal intubation is performed under direct vision by using a laryngoscope. Tracheal intubation using this technique is, however, often associated with an increase in blood pressure and heart rate,^{1,2} which may be severe in hypertensive patients.³ These changes greatly increase the risk of myocardial infarction or stroke, especially in elderly patients with hypertension.⁴⁻⁶ Kitamura *et al.*^{7,8} have recently described a new fiberoptic stylet scope (Styletscope™; Nihon Kohden, Tokyo, Japan, Figure 1A), for tracheal intubation. The stylet scope has the shape of a standard stylet, with the addition of a fiberoptic view and manoeuvrability at its tip (Figure 1A). It was originally designed as an alternative to failed or difficult tracheal intubation. Since only elevation of the tongue is required for tracheal intubation when using the stylet scope with a laryngoscope as an adjunct,⁷ it is expected that the use of this device can attenuate precipitous hemodynamic changes, especially in hypertensive patients. This study was undertaken to evaluate hemodynamic changes after tracheal intuba-

tion using the stylet scope and a Macintosh laryngoscope in normotensive and hypertensive patients.

Methods

After obtaining Institutional approval and informed consent from each patient, 30 normotensive patients (ASA physical status I) and 30 hypertensive patients (ASA physical status II) scheduled for elective surgery under general anesthesia were enrolled in this study. Patients with one of the following conditions were excluded: pulmonary disease, a history of previous difficult intubation, cervical spine fracture, and tumours or polyps of the upper airway. Hypertension was diagnosed if systolic blood pressure was >160 mmHg and/or diastolic blood pressure >95 mmHg (as defined by the World Health Organization). All hypertensive patients were already receiving oral medication consisting of a calcium antagonist (nifedipine, benidipine and/or amlodipine) and received their medication six hours before induction of anesthesia. Normotensive and hypertensive patients were randomly (by flipping a coin) assigned to one of the fol-

FIGURE 1 The new fiberoptic stylet scope, Styletscope™. A, By depressing the lever of the proximal handle, the distal tip of the stylet, together with the endotracheal tube, can be flexed 90°. B, After lifting the tongue lightly using a standard laryngoscope blade, tracheal intubation is performed with the glottic opening viewed only via the stylet scope.

A. Normotensive group

B. Hypertensive group

FIGURE 2 Hemodynamic changes after tracheal intubation in normotensive (SN and LN groups, left panel) and hypertensive (SH and LH groups, right panel) patients. All values are expressed as means. B, baseline; BI, before induction; AI, immediately after intubation; one, two, three, four, and five, number of minutes after intubation. * $P < 0.05$ compared with baseline values.

lowing groups: 1) patients with hypertension intubated by using a stylet scope with a laryngoscope as an adjuvant (SH group, $n=15$); 2) patients without hypertension intubated by using a stylet scope with a laryngoscope as an adjuvant (SN group, $n=15$); 3) patients with hypertension intubated by using a laryngoscope (LH group, $n=15$); and 4) patients without hypertension intubated by using a laryngoscope (LN group, $n=15$).

Patients were premedicated with $1.0 \text{ mg}\cdot\text{kg}^{-1}$ pentobarbitone *po* and $0.01 \text{ mg}\cdot\text{kg}^{-1}$ atropine *im* 30 min before the induction of anesthesia. Anesthesia was induced with $2.0 \text{ }\mu\text{g}\cdot\text{kg}^{-1}$ fentanyl *iv*, followed by $4 \text{ mg}\cdot\text{kg}^{-1}$ thiamylal *iv* one minute later. Vecuronium,

$0.15 \text{ mg}\cdot\text{kg}^{-1}$ *iv*, was given after loss of consciousness, and the lungs were ventilated via a mask with $4 \text{ L}\cdot\text{min}^{-1}$ N_2O , $2 \text{ L}\cdot\text{min}^{-1}$ O_2 , and 5% sevoflurane. The trachea was then intubated orally by using either a stylet scope with a laryngoscope as an adjuvant or a Macintosh laryngoscope (blade #2) three minutes after the administration of vecuronium. In the SN and SH groups, the tongue was lifted gently by the laryngoscope blade, and the epiglottis and vocal cords were viewed only through the stylet scope (Figure 1B).

All intubations were performed by a single investigator well experienced in using a stylet scope and laryngoscope. Only one attempt at intubation was allowed for both techniques, and it was decided to

TABLE I Demographic characteristics of the subjects

	Normotensive group (n=30)		Hypertensive group (n=30)	
	Laryngoscope (n= 15)	Stylet scope (n=15)	Laryngoscope (n=15)	Stylet scope (n=15)
Gender (male/female)	8/7	9/6	9/6	6/9
Age (yr)	56.2 ± 7.6	58.4 ± 7.6	59.5 ± 6.9	64.1 ± 9.1
Weight (kg)	61.2 ± 5.8	58.4 ± 7.6	59.5 ± 6.9	64.1 ± 9.1
Height (cm)	159.2 ± 12.1	163.2 ± 10.1	159.8 ± 9.1	162.1 ± 5.8
Blood pressure (mmHg)				
Systolic	123.4 ± 10.2	121.1 ± 12.5	148.8 ± 18.2 *†	151.0 ± 15.2*†
Diastolic	68.2 ± 5.2	70.6 ± 5.4	86.3 ± 8.9*†	88.4 ± 5.9*†
Heart rate beats·min ⁻¹	70.2 ± 6.7	72.5 ± 7.2	68.2 ± 8.9	65.7 ± 9.2
Medical treatment	Nifedipine, benidipine, and/or amlodipine			

Data are expressed as mean ± SD. **P* <0.05 *vs* laryngoscope in normotensive group. †*P* <0.05 *vs* stylet scope in normotensive group.

TABLE II Duration of intubation and complications

	Normotensive group (n=30)		Hypertensive group (n=30)	
	Laryngoscope (n=15)	Stylet scope (n=15)	Laryngoscope (n=15)	Stylet scope (n=15)
Duration of intubation (s)	16.2 ± 3.5	17.2 ± 4.3	15.5 ± 2.6	16.6 ± 4.5
Complications				
Sore throat	5	2*	4	1†
Hoarseness of voice	1	1	1	0

Data are expressed as mean ± SD or number. **P* <0.05 *vs* laryngoscope group in normotensive group. †*P* <0.05 *vs* laryngoscope group in hypertensive group.

exclude cases in which initial tracheal intubation was not successful from the study. The duration of tracheal intubation, that is, the time from the introduction of the device into the oral cavity until its removal, was recorded. Blood pressure and heart rate were recorded at the following time points: 1) before the administration of fentanyl (control), 2) two minutes after the administration of vecuronium (before intubation), 3) immediately after tracheal intubation, and 4) one, two, three, four, and five minutes after tracheal intubation. All patients were asked about sore throat and hoarseness of voice on the following day.

Data are expressed as numbers, means or means ± SD. Hemodynamic changes during intubation were analyzed using one-way ANOVA for repeated measurements with Fisher’s test or unpaired two-tailed *t* test. Postoperative complications were analyzed using the ² test. In all comparisons, *P* <0.05 was considered significant.

Results

All four groups were comparable with respect to gender, age, weight, height, and heart rate (Table I). Blood pressures in the hypertensive groups (SH and LH groups)

were significantly higher than those in the normotensive groups (SN and LN groups) before the induction of anesthesia. There was no case in which more than one attempt was needed to intubate the trachea.

Hemodynamic changes after tracheal intubation in normotensive and hypertensive groups are shown in Figure 2. Patients in both the stylet scope and laryngoscope groups showed significant decreases in blood pressure after anesthetic induction and maximum increases in blood pressure one minute after tracheal intubation. The heart rate did not decrease following anesthetic induction, and it increased after tracheal intubation, peaking at one minute after tracheal intubation. When comparing hemodynamic changes from “before intubation” to “one minute after intubation,” patients in the normotensive groups (both SN and LN groups) showed significant increases in both systolic and diastolic blood pressures. However, blood pressures in the SN group were significantly lower than those in the LN group. Similarly, patients in the LH group showed significant increases in both systolic and diastolic blood pressures, but these values did not change in the SH group. Heart rates in all four groups showed significant increases, and there were no signif-

icant differences between heart rates in the stylet scope and laryngoscope groups or between normotensive and hypertensive groups.

The number of patients who complained of sore throat was greater in the laryngoscope groups, although no differences were found in the incidence of hoarseness of voice (Table II).

Discussion

One of the main findings of this study is that there were smaller changes in blood pressure after tracheal intubation using a stylet scope than there were using conventional laryngoscopy in both normotensive and hypertensive patients. Orotracheal intubation with a laryngoscope requires elevation of the epiglottis and exposure of the glottis by lifting of the laryngoscope blade forward and upward. These procedures are associated with hemodynamic changes.¹⁻³ One of the reasons for the smaller hemodynamic changes following tracheal intubation using a stylet scope was, probably, less stimulus to the perilaryngeal area. Similar investigations using a lightwand (Trachlight™, Laerdal Medical, Armonk, NY, USA) technique have been conducted,^{9,10} since this method of intubation requires neither elevation of the epiglottis by the laryngoscope blade nor exposure of the glottic opening. However, both Hirabayashi *et al.*⁹ and Nishikawa *et al.*¹⁰ found that the circulatory responses to tracheal intubation were similar to those of direct-vision laryngoscopy. Hirabayashi *et al.*⁹ used a jaw-lifting technique for lightwand intubation, and they speculated that the magnitude of this stimulus was sufficient to cause a circulatory response.⁹ Nishikawa *et al.*¹⁰ required significantly more time for intubation and a greater number of attempts at intubation using the lightwand technique, compared to laryngoscopy. The technique employed in our study required only a short period of time and no jaw lifting for intubation. Heart rates in all four groups showed significant increases; however, there were no differences between groups. It is possible that premedication with atropine may have affected our results in this respect.

Another finding of this study is that the number of patients who complained of sore throat was greater in the laryngoscope group, although no differences were found in the incidence of hoarseness of voice. One of the reasons for the reduced frequency of sore throat in the stylet scope group might be the lack of direct stimuli to the mouth and the larynx. Nishikawa *et al.*¹⁰ reported that the number of patients who complained of hoarseness after tracheal intubation using the lightwand technique was greater than that after intubation using direct laryngoscopy. If the tip of the lightwand

does not enter the trachea directly, an intense stimulus is applied to the upper airway,¹¹ which may injure the vocal cords as well as the perilaryngeal tissue. It would therefore be an advantage to intubate the trachea under direct vision of the vocal cords through a stylet scope.

In conclusion, tracheal intubation using a stylet scope (with a laryngoscope as an adjuvant) can attenuate hemodynamic responses and reduce the incidence of sore throat in comparison with conventional laryngoscopy both in normotensive and hypertensive patients.

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