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Effects of lightwand (Trachlight) compared with direct laryngoscopy on circulatory responses to tracheal intubation

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Summary

We compared the effects of the lightwand technique on circulatory responses to tracheal intubation with those of direct-vision laryngoscopy. Forty adult patients received propofol and vecuronium, and their lungs were ventilated for 2 min via a mask with 5% sevoflurane in oxygen, after which the trachea was intubated orally using either the lightwand (Trachlight, $n=20$) or the Macintosh laryngoscope ($n=20$). Maximum mean arterial pressure changes did not differ between groups during (lightwand group, 25 (SD 21) mm Hg *vs* laryngoscopy group, 23 (19) mm Hg) and after (21 (24) mm Hg *vs* 21 (16) mm Hg) tracheal intubation. Maximum heart rate changes were similar for groups during (16 (14) beat min^{-1} *vs* 16 (15) beat min^{-1}) and after (2 (11) beat min^{-1} *vs* 7 (19) beat min^{-1}) tracheal intubation. There were no differences between the lightwand technique and direct-vision laryngoscopy in changes in mean arterial pressure and heart rate during and after tracheal intubation. We conclude that the effects of the lightwand technique on circulatory responses to tracheal intubation were similar to those of direct-vision laryngoscopy. (*Br. J. Anaesth.* 1998; **81**: 253–255)

Keywords: intubation, tracheal; anaesthetic techniques, lightwand; anaesthetic techniques, laryngoscopy

Tracheal intubation by direct vision using a laryngoscope after rapid sequence induction of anaesthesia is frequently associated with circulatory changes.[1–4] The circulatory changes occur in response to the stimuli of both direct-vision laryngoscopy and placement of the tube in the trachea. In particular, the circulatory changes are severe when the duration of direct-vision laryngoscopy is prolonged.[5] In contrast, transillumination of the soft tissue of the neck using a lightwand (Trachlight, Laerdal Medical, Armonk, NY, USA) is a gentle intubating technique in which no direct-vision laryngoscopy is required.[6–8] We therefore hypothesized that this gentle intubating technique using the Trachlight would be associated with less circulatory changes compared with the standard technique using direct-vision laryngoscopy. The aim of this study was to compare the effects of lightwand technique on circulatory responses to tracheal intubation with those of direct-vision laryngoscopy.

Methods and results

The study was approved by the Hospital Ethics Committee and informed consent was obtained from 40 patients, ASA I or II, undergoing elective (abdominal, orthopaedic, or otorhinological) surgery. Patients with hypertension, cardiovascular disease or arteriosclerotic disease were excluded from the study. Preanaesthetic medication consisted of atropine (0.5 mg) and hydroxyzine (50 mg) i.m. Upon arrival in the operating room patients were monitored with ECG lead II for measuring heart rate, and an 18-gauge i.v. catheter was inserted in an upper extremity vein. A local anaesthetic (1% mepivacaine) was injected intradermally with a 26-gauge needle, and a 22-gauge catheter was inserted in a radial artery to permit continuous recording of systolic and diastolic arterial pressures. Anaesthesia was induced with a propofol solution (0.2 ml kg^{-1}), which consisted of propofol 180 mg and lidocaine 40 mg in a total volume of 20 ml, followed by vecuronium (0.1 mg kg^{-1}). The lungs of all the patients were ventilated for 2 min via a mask with 5% sevoflurane in oxygen, and then the trachea was intubated orally using either the lightwand (Trachlight, $n=20$) or the Macintosh laryngoscope ($n=20$). The allocation to the two groups was randomly performed using sealed envelopes but not blinded to the investigator. Anaesthesia was maintained with 3% sevoflurane and 66% nitrous oxide in oxygen for 3 min. After the study period, the anaesthetics used were not standardized. Arterial pressure and heart rate were recorded at the following times: (A) before anaesthesia induction, (B) 2 min after anaesthesia induction before tracheal intubation, (C) when the trachea was just intubated, (D) maximum increase after tracheal intubation, (E) 1 min after tracheal intubation, (F) 2 min after (radical intubation, and (G) 3 min after tracheal intubation. The time necessary to place a tracheal tube and the time of maximum increase in arterial pressure after tracheal intubation was measured by a stopwatch.

Statistical analyses were performed with the StatView SE package (Abacus Concepts, CA, USA) on a Power Macintosh 7200 (Apple Computer Inc., CA, USA). Patient characteristics were compared

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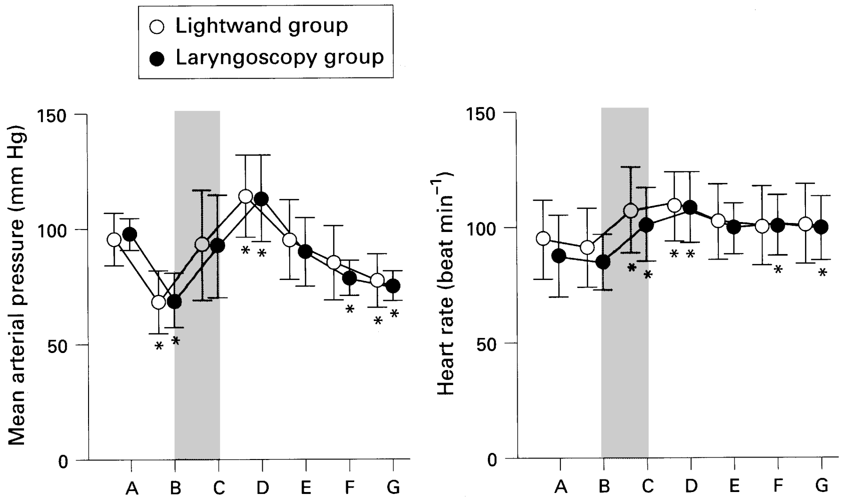

Figure 1 Mean arterial pressure (left panel) and heart rate (right panel) in the lightwand (open symbols) and laryngoscopy (closed symbols) groups. A: before anaesthesia induction; B: 2 min after anaesthesia induction before tracheal intubation; C: when the trachea was just intubated; D: maximum increase after tracheal intubation (23 (12) s after tracheal intubation in the lightwand group and 23 (9) s in the laryngoscopy group); E: 1 min after tracheal intubation; F: 2 min after tracheal intubation; and G: 3 min after tracheal intubation. The shaded area indicates the duration of the lightwand technique (22 (11) s) or laryngoscopy (24 (11) s). $^*P<0.05$ compared with before anaesthesia induction. No significant differences were found between the two groups in changes in mean arterial pressure and heart rate.

using Student's *t* test. Within group changes over time were analysed with analysis of variance (ANOVA) for repeated measures. Between group differences were compared using ANOVA for factors. If significant differences were observed, Scheffe *F* was used for *post hoc* analysis. Data are presented as mean (SD). $P<0.05$ was considered statistically significant.

Patients in the two groups were comparable in age (lightwand group, 44 (22–69) yr *vs* laryngoscopy group, 40 (22–77) yr), weight (58 (12) kg *vs* 55 (9) kg) and height (159 (8) cm *vs* 161 (9) cm). The time necessary to place a tracheal tube did not differ between groups (22 (11) s *vs* 24 (11) s).

After anaesthesia induction, mean arterial pressure decreased to a similar extent in both groups ($P<0.05$, fig. 1). The increase in mean arterial pressure during tracheal intubation did not differ between the groups (25 (21) mm Hg *vs* 23 (19) mm Hg), and an additional increase in mean arterial pressure after tracheal intubation was not different between the groups (21 (24) mm Hg *vs* 21 (16) mm Hg). The time of maximum increase in mean arterial pressure after tracheal intubation did not differ between the groups (23 (12) s *vs* 23 (9) s). In both the groups, maximum mean arterial pressure after tracheal intubation was significantly greater ($P<0.05$), from the preanaesthetic values, and this decreased within 1 min. No significant differences in mean arterial pressure changes were found between the groups at any time.

Heart rate after anaesthesia induction did not differ between the groups (fig. 1). The increase in heart rate during tracheal intubation was not different between groups (16 (14) beat min^{-1} *vs* 16 (15) beat min^{-1}). In both groups, heart rate after tracheal intubation was significantly greater ($P<0.05$), compared with the preanaesthetic values. The increase in heart rate after tracheal intubation did not differ between groups (2 (11) beat min^{-1} *vs* 7 (19) beat min^{-1}). There were no significant differences in heart rate changes at any time between the groups.

Comments

Orotracheal intubation using the direct-vision laryngoscopy requires elevation of the epiglottis and exposure of the glottic opening. The elevation of the epiglottis and exposure of the glottis opening is obtained by a forward and upward movement of the laryngoscope blade exerted along the axis of the laryngoscope handle, and may result in circulatory responses. In contrast with direct-vision laryngoscopy, the lightwand method of intubation requires neither elevation of the epiglottis by the laryngoscope blade nor exposure of the glottic opening. We predicted that this gentle technique would cause less circulatory changes than standard direct-vision laryngoscopy. In contrast with our expectation, we found that the circulatory responses to tracheal intubation were similar to those of direct-vision laryngoscopy.

Both mean arterial pressure and heart rate increased significantly in our laryngoscopy group. These may reflect the stimulus of the areas being in contact with the laryngoscopy blade. In the lightwand group we also found the significant circulatory changes which were comparable to the laryngoscopy group. In the technique for lightwand intubation, the jaw is grasped and lifted upward using the thumb and index finger of the intubator's hand. This lifts the tongue and epiglottis off the posterior pharyngeal wall to make a clear passage for the tracheal tube to enter the glottic opening.[7] This manoeuvre seems to be gentle compared with the direct-vision laryngoscopy. The results of the present study, however, suggest that the magnitude of this stimulus was sufficient to cause circulatory responses.

When the tracheal tube was placed, an additional increase in mean arterial pressure was found in both the groups. Maximum pressure response to direct-vision laryngoscopy has been reported by 45 s.[5] In the present study the time necessary to place a tracheal tube was 22 (11) s in the lightwand group and 24 (11) s in the laryngoscopy group, so maximum pressure responses might not have taken place and the placement of the tracheal tube would hence result in the additional increase in mean arterial pressure after tracheal intubation.

None of the patients examined in this study had hypertension, cardiovascular disease or arteriosclerotic disease. Reduction of pressure responses to tracheal intubation might be important in such patients. Investigations of the lightwand technique on circulatory responses to tracheal intubation in such patients would be of interest.

Finally, in the current study atropine was applied during premedication. Atropine may alter circulatory responses to tracheal intubation. However, because all patients received atropine for premedication, the comparison of these two groups is valid.

In summary, this study has shown that there were no differences between the lightwand technique and direct-vision laryngoscopy in the changes in mean arterial pressure and heart rate during and after tracheal intubation. We conclude that the effects of lightwand technique on circulatory responses to tracheal intubation were similar to those of direct-vision laryngoscopy.

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