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Laryngotracheal application of lidocaine spray increases the incidence of postoperative sore throat after total intravenous anesthesia

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Abstract
Purpose. To determine the effect of laryngotracheal application of different doses of lidocaine spray on postoperative sore throat and hoarseness, we evaluated the incidence and severity of these complications in 168 ASA I–III patients aged 15–92 years in a placebo-controlled study.
Methods. After induction of anesthesia with propofol, ketamine, fentanyl, and vecuronium, the laryngotracheal area was sprayed immediately before intubation with lidocaine spray either 5 times (L5 group, $n = 47$) or 10 times (L10 group, $n = 48$) or with normal saline 1 ml (placebo group, $n = 51$). Postoperative sore throat and hoarseness were evaluated immediately after surgery and on the day after surgery.
Results. The incidence of sore throat was significantly higher in the L10 group than in the placebo group on both the day of and the day after surgery. The severity of sore throat was significantly higher in the L5 and L10 groups than in the placebo group on the day of surgery. On the day after surgery, the severity of sore throat remained significantly higher in the L10 group than in the placebo group. Although the incidence and severity of sore throat increased in a dose-dependent manner, these were not significantly different between the L5 and L10 groups. In addition, the incidence and severity of hoarseness did not differ at all among the three groups.
Conclusion. We recommend that applications of lidocaine spray to the laryngotracheal area should be avoided to help eliminate unnecessary postoperative sore throat, thereby leading to improvement in patient satisfaction.

Key words Intubation · Tracheal tube · Complications · General anesthesia

Introduction

Postoperative sore throat and hoarseness, common complications after tracheal intubation, affect postoperative satisfaction of the patient. Recently, we reported that laryngotracheal lidocaine spray is a significant causative factor of postoperative sore throat and hoarseness after total intravenous anesthesia [1]. The purpose of the present study was to prospectively evaluate, in a placebo-controlled study, the effect of various doses of lidocaine spray applied immediately before intubation on incidence and severity of sore throat and hoarseness after total intravenous anesthesia.

Materials and methods

This prospective study was approved by the ethics committee of Iida Municipal Hospital, and informed consent was obtained from all patients. We initially enrolled 168 ASA physical status I–III patients, aged 15–92 years, who were scheduled over a 36-week period for elective surgery in the supine position. Patients underwent head and neck surgery or oral surgery, and patients requiring nasogastric tube placement were excluded. Also excluded were patients who underwent multiple attempts at laryngoscopy. We preliminarily divided the 36-week period into three sequential time periods: period 1, 10 sprays of lidocaine (8%, Xylocaine pump spray; AstraZeneca, Soedertaelje, Sweden) were applied to the larynx and trachea during laryngoscopy (L10 group); period 2, 5 sprays of lidocaine were applied to the larynx and trachea during laryngoscopy (L5 group); and period 3, normal saline 1 ml was sprayed (placebo group). Patients were systematically allocated to one of the three study groups according to the time period in which they underwent surgery.

Patients were premedicated with 20 mg raftidine, an H_2 blocker, 120 min before induction. Standard monitoring, including electrocardiography, noninvasive blood pressure, and pulse oxymetry, was applied. After giving 100% oxygen at 61 for several minutes, total intravenous anesthesia was induced with propofol

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1–2 mg·kg^{-1}, ketamine 0.5–1 mg·kg^{-1}, fentanyl 1–2 μg·kg^{-1}, and vecuronium 0.1 mg·kg^{-1}. Thereafter, anesthesia was maintained by total intravenous anesthesia using propofol, fentanyl, and ketamine, with or without epidural block. Two milliliters 2% lidocaine was first administered intravenously to alleviate pain from the i.v. propofol administration. Laryngoscopy was performed 3 min after vecuronium injection.

Immediately before intubation, one of three solutions was sprayed on the vocal cords and into the trachea. The spray device delivering the lidocaine spray is regulated to deliver approximately 1 ml lidocaine with 10 sprays. Normal saline was applied with another spray device (Spray Tip; Nipro, Osaka, Japan) attached to a 2-ml syringe. Duration of laryngoscopy was measured in each patient. Intubation was facilitated with a tracheal tube with standard cuff (Trachelon, Telmo, Tokyo, Japan) and an internal diameter of 7–8 mm (for women) or 8–9 mm (for men). The cuff was inflated until no air leak could be heard with speak airway pressure at 20 cm H_2O. An esophageal temperature probe was inserted in each patient. The anesthesiologist in charge asked the patients about sore throat and hoarseness before they left the operating room and on the next morning after surgery. At the time of the first evaluation, the degree of sedation was assessed by the modified Ramsey Sedation Score (modified RSS: 1, patients anxious or agitated or both; 2, patient cooperative, oriented, and tranquil; 3, patient responds to commands only; 4, patient responds to a glabellar tap; 5, patient does not respond) [2]. Patients who received a modified RSS of 1, 4, or 5 were regarded as inappropriate candidates for this study and were excluded. Patients with positive symptoms of sore throat or hoarseness were graded to evaluate the severity as follows: for sore throat, (0) no complaints, (1) minimal sore throat, (2) moderate sore throat, (3) severe sore throat; and for hoarseness, (0) no complaints, (1) slight hoarseness, (2) severe hoarseness, (3) cannot speak because of hoarseness.

Results are expressed as either mean ± SD or median with 10th and 90th percentiles. Analysis of variance (ANOVA) was used to analyze patient age, height, weight, and duration of laryngoscopy and intubation. Fisher's protected least squares difference (PLSD) was used as a post hoc test. Patient sex and incidences of sore throat and hoarseness were compared with the chi-square test. The Kruskal–Wallis and Mann–Whitney tests were used to compared the severity of symptoms between groups. We used duration of laryngoscopy and the number of times of lidocaine spray as the variables in a logistic regression analysis to identify which factor is associated with sore throat and hoarseness, because duration of laryngoscopy is thought to be much longer in the L10 group than the placebo and L5 group. Statistical analysis was done with StatView version 5.0 (SAS Institute Inc., Cary, NC, USA). A probability of less than 0.05 was considered significant.

Results

Twenty-eight patients were excluded because of inappropriate sedation or multiple attempts at laryngoscopy. Therefore, 140 patients comprised the present study. Patient characteristics are shown in Table 1. There were no significant differences among the three groups with regard to sex, age, height, weight, and duration of intubation. However, duration of laryngoscopy in the L10 group was significantly longer than that in the other two groups ($P < 0.01$).

The incidence of sore throat was significantly higher in the L10 group than in the placebo group on both the day of and the day after surgery ($P < 0.05$) (Table 2). The severity of hoarseness and sore throat is summarized in Table 3. The severity of sore throat was significantly higher in the L5 and L10 groups than in the placebo group on the day of surgery ($P < 0.05$ in the L5 group, $P < 0.01$ in the L10 group). On the day after surgery, the severity of sore throat remained significantly higher in the L10 group than in the placebo group ($P < 0.05$). In the logistic regression analysis, not duration of laryngoscopy but the number of times of

Table 1. Patient characteristics per study group

	Normal saline ($n = 47$)	5 sprays ($n = 46$)	10 sprays ($n = 47$)
Sex (Female/male)	28/19	28/18	30/17
Age (years)	57.9 ± 18.1	59.1 ± 20.2	60.3 ± 16.1
Height (cm)	158.1 ± 8.6	157.3 ± 7.7	154.5 ± 10.0
Weight (kg)	54.0 ± 8.9	53.9 ± 8.9	55.8 ± 8.6
Duration of laryngoscopy (sec)	15.4 ± 4.4**	16.8 ± 8.3**	25.8 ± 14.7
Duration of intubation (min)	152.7 ± 69.3	149.7 ± 71.1	146.3 ± 52.5

Values are mean ± SD for age, height, weight, duration of laryngosocpy, and duration of intubation

** $P < 0.01$, in comparison to 10 sprays

Table 2. Incidences of postoperative sore throat and hoarseness

	Normal saline ($n = 47$)	5 sprays ($n = 46$)	10 sprays ($n = 47$)
Day of surgery			
Sore throat (%)	27.7 (13/47)	45.7 (21/46)	57.4 (27/47)*
Hoarseness (%)	42.6 (20/47)	47.8 (22/46)	59.6 (28/47)
Day after surgery			
Sore throat (%)	8.5 (4/47)	15.2 (7/46)	29.8 (14/47)*
Hoarseness (%)	21.8 (10/47)	13.0 (6/46)	25.5 (12/47)

Values are percentages, and ratios are given in parentheses
* $P < 0.05$, in comparison to normal saline

Table 3. Severities of postoperative sore throat and hoarseness

	Normal saline ($n = 47$)	5 sprays ($n = 46$)	10 sprays ($n = 47$)
Day of surgery			
Sore throat	0 (0–2)	0 (0–2)*	2 (0–2.8)**
Hoarseness	0 (0–1)	0 (0–2)	1 (0–2)
Day after surgery			
Sore throat	0 (0–0)	0 (0–1)	0 (0–2)*
Hoarseness	0 (0–1)	0 (0–1)	0 (0–1)

Data are median with 10th and 90th percentiles given in parentheses: sore throat was graded as 0, absent; 1, minimal; 2, moderate; 3, severe. Hoarseness was graded as 0, absent; 1, slight; 2, severe; 3, preventing speech
* $P < 0.05$, ** $P < 0.01$, in comparison to normal saline

lidocaine spray was considered the significant factor of postoperative sore throat for both the day of surgery (odds ratio 1.12 and 1.02–1.23 of 95% confidence interval) and the day after surgery (1.19 and 1.05–1.35, respectively).

However, both the incidence and severity of hoarseness did not differ throughout the study. Neither the incidence nor severity of sore throat and hoarseness in the L5 group differed significantly from that in the L10 group (see Tables 2, 3).

Discussion

Sore throat and hoarseness are common postoperative complaints associated with tracheal intubation. Several causal factors, such as sex, large tracheal tube size, cuff design, and increase of intracuff pressure by nitrous oxide have been reported [3–9]. Although laryngotracheal lidocaine spray is widely used before intubation in clinical practice, there are only a few studies evaluating its effect on postoperative sore throat and hoarseness, and the data are not consistent. Herlevsen et al. [10] investigated the effect of lidocaine spray during laryngoscopy on prevention of postoperative sore throat in a double-blind manner. Although these authors commented that the use of lidocaine spray was not recommended, the incidence of sore throat was not statistically significant in spite of additional laryngoscopy performed to allow application of the lidocaine spray. Klemola et al. [11] also studied the effect of lidocaine spray on sore throat in combination with lidocaine jelly on the tracheal tube. They reported that lidocaine spray itself did not play a significant role in the incidences of sore throat or hoarseness; however, the concomitant use of lidocaine spray and jelly worsened these complications. Our data clearly showed that laryngotracheal application of lidocaine spray significantly increased the incidence and severity of sore throat over that seen in the placebo group.

There are several possible causes for the increased incidence and severity seen in the L10 group. First, patients in the L10 group were exposed to longer laryngoscopy times than those of the other groups, presumably to deliver the 10 sprays of lidocaine. Longer duration of laryngoscopy could affect the incidence of sore throat and hoarseness. However, the result of logistic regression analysis demonstrated that not duration of laryngoscopy but the number of times of lidocaine spray was a significant factor for postoperative sore throat in the present study. Therefore, we believe that the lidocaine spray itself plays a significant role in deteriorating postoperative sore throat. Second, the additives contained in lidocaine spray may have an effect on postoperative sore throat and hoarseness. The aerosolized products used in Japan contain l-menthol, etha-

nol, saccharin sodium, and macrogolum as additives in an alkalized solvent of pH 9.0–9.2. Among these additives, l-menthol and ethanol can irritate tracheal mucosa. Duration of the hypoalgesic effect of lidocaine spray is less than 15 min [12]. By the end of surgery, the analgesic effect of lidocaine spray might have worn off, and the irritating effect of the additives might have been elicited. Therefore, we speculated that these additives or the alkalized solvent itself might add to the damage inflicted on the tracheal mucosa during intubation, thus leading to an increase in the incidence and severity of sore throat.

Although the incidence of sore throat was increased and severity of symptoms was associated with lidocaine spray in a dose-dependent manner, only the differences between the placebo and L10 group were statistically significant in the present study. Tracheal application of lidocaine 2 min before intubation attenuates the cardiovascular response to mechanical stimulation accompanying laryngoscopy and intubation [13]. In that study, such effects were not observed in the patients with lidocaine application to the trachea immediately before intubation. Therefore, 5 applications of lidocaine spray to the laryngotracheal area at least 2 min before intubation may be acceptable to avoid cardiovascular fluctuation following laryngoscopy and tracheal intubation without increasing the incidence of postoperative sore throat.

The timing of the first evaluation of postoperative sore throat and hoarseness in the present study may be questioned. Patients with modified RSS of 1, 4, or 5 were excluded at the first evaluation because we regarded the sedation status of these patients as inappropriate for assessment of these symptoms. However, fentanyl or ketamine still circulating in the bloodstream could also have some effect on the patient's ability to accurately evaluate feelings of sore throat and hoarseness. In addition, the present study was conducted as a placebo-controlled study; however, the methodology may also be questioned. To determine the effect of lidocaine spray on postoperative throat complications, further studies of randomized, double-blinded, and placebo-controlled design are required.

In conclusion, application of lidocaine spray to the laryngotracheal area increased the incidence and severity of sore throat. We recommend that routine application of lidocaine spray during laryngoscopy should be avoided to eliminate unnecessary complications of postoperative sore throat.

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