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Original Article

Lidocaine spray on an endoscope immediately before insertion improves patient tolerance to endoscopy: A single center, clinical observational study

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ABSTRACT

Background: Topical pharyngeal anesthesia reduces discomfort during upper gastrointestinal endoscopy (UGIE) but may not increase tolerance to the procedure. This case-control study was performed to assess whether lidocaine spray on the endoscope in addition to pharyngeal anesthesia improves patient tolerance to endoscopy we performed.

Methods: Patients who underwent UGIE were assigned to either the case group where the endoscope was treated with 2 sprays of 10% lidocaine before insertion or the control group given only conventional pharyngeal anesthesia. And we compared the frequency of belching and retching during endoscopy.

Results: Among 497 eligible patients, 262 were assigned to the case group and 235 to the control group. There were significant differences between the two groups in belching (odds ratio [OR] = 0.15, 95% confidence interval [CI] = 0.09–0.24, $P < 0.01$) and retching (OR = 0.22, 95% CI = 0.15–0.34, $P = 0.01$) during endoscopy using multivariate analysis. Younger patients (OR = 0.96, 95% CI = 0.94–0.98, $P < 0.01$) and female patients (OR = 2.16, 95% CI = 1.40–3.33, $P = 0.01$) had belching more frequently than older patients and male patients, respectively. Retching was more frequent in sedated patients (OR = 0.39, 95% CI = 0.25–0.61, $P = 0.01$) and those with gastro-esophageal reflux disease (OR = 1.48, 95% CI = 1.00–2.21, $P = 0.06$).

Conclusion: Use of lidocaine spray on the endoscope improves patient tolerance during UGIE compared to only conventional pharyngeal anesthesia.

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Keywords: Belching; Endoscopy; gastrointestinal; Gagging; Lidocaine; Pharyngeal anesthesia

Introduction

Endoscopy is the most effective method to screen for upper gastrointestinal (GI) diseases, which have been increasing yearly. In 2005, more than 7 million upper GI endoscopies (UGIE) were performed in South Korea.¹ The procedure can be accompanied by belching, retching, or pain, causing many subjects to be reluctant to receive endoscopy. Topical pharyngeal anesthesia in non-sedated patients has been the standard method for reducing these side effects since the 1970s.² However, many patients still experience these discomforts, causing practitioners to question the usefulness of pharyngeal anesthesia.³ We tested whether the

addition of lidocaine spray on the endoscope tip increased patient tolerance to endoscopy compared to pharyngeal anesthesia alone.

Methods

An observational study was performed in a single tertiary referral center. The study protocol was approved by the Institute Review Board of the Cheju Halla General Hospital and was registered to www.clinicaltrials.gov (identifier No.: NCT02307773).

Consecutive patients who underwent UGIE in Room 2 of the Endoscopic Unit, Digestive Disease Center, Cheju Halla General Hospital, Jeju, Korea between November 4, 2013 and May 7, 2014

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were enrolled in the study. Patients were excluded from the study if they were > 90 or < 15 years old, had comorbidity scores > III using the American Society of Anesthesiologists Physical Status Classification System, had a history of hypersensitivity to lidocaine or sedatives, had been diagnosed with a psychiatric disease, were mentally impaired, were pregnant or breastfeeding, had a history of dependence on narcotics, opioids, or alcohol, had a body mass index > 36 kg/m², had unstable vital signs prior to the procedure, or underwent emergency endoscopy.

Premedication and procedure

All participants were provided with pre-endoscopic education that included information about how the endoscopic procedure would be carried out, all potential adverse events, and techniques utilized to manage discomfort during endoscopy. Pharyngeal anesthesia was performed by registered nurses using 2 sprays of lidocaine 10% spray (Beracaine Spray, lidocaine 10%, 10 mg/spray; Sung Kwang Pharm Co., Ltd., Seoul, Korea). Patients were then asked to confirm the absence of throat sensation. Antispasmodics (Frepan, butylbromide 20 mg; Jeil Pharmaceutical Co., Ltd., Seoul, Korea) were injected intramuscularly to every patient. All patients were also given gas-s scavenging agents (Gasocol Susp., simethicone 20 mg/mL; Taejoon Pharm Co., Ltd., Seoul, Korea).

For participants assigned to the case group, 2 sprays of the 10% lidocaine spray which was used for pharyngeal anesthesia were applied to the tip of the endoscope (from end of the tip to 4–5 cm) prior to insertion in addition to the pharyngeal anesthesia (Beracaine Spray, lidocaine 10%, 10 mg/spray; Sung Kwang Pharm Co., Ltd.), while the control group received only the pharyngeal anesthesia. All endoscopies were performed with an Olympus GIF-Q260 or GIF-Q-240 (Olympus, Seoul, Korea) endoscope by a single board certified expert endoscopist who had performed more than 2,000 endoscopy procedures annually. Every procedure was performed using identical operating procedures, including air insufflation or suction, biopsy time, taking pictures, or sequence of inspection. Midazolam 0.15 mg/kg (Daewon Pharmaceuticals Co., Seoul, Korea) injected intravenously was used for sedation and 2 to 6 mg of etomidate was added for some patients. The target sedation level was determined to be 3 or more on the Ramsay Sedation Scale.⁴ All medications were administered and monitored by board certified nurses.

Monitors

Baseline patient characteristics were recorded including age, sex, prior endoscopies, and history of various GI disorder-associated symptoms. Vital signs including blood pressure, pulse rate, respiration rate, and peripheral oxygen saturation (SpO₂) were measured before and after the endoscopy. Sedated patients were monitored for these vital signs throughout the endoscopy.

Clinical variables related to the endoscopic procedure such as sedation, duration of the endoscopy, whether a biopsy was performed, and the diagnosis (such as gastro-esophageal reflux disease [GERD] or peptic ulcer disease [PUD]) were recorded. Endoscopy duration was defined as the time period from insertion of the scope into the oral cavity to its removal. GERD and PUD were diagnosed according to the Los Angeles Classification.⁵

Primary endpoints analyzed were the frequency of belching and retching during the endoscopic procedure as counted by an independent observer. Retching was defined as reverse peristaltic movement of the stomach and esophagus without vomiting. Belching was defined as a release of gas from the digestive tract

(mainly the esophagus and stomach) through the mouth retching and belching events that occurred before the scope passed through the upper esophageal sphincter and after withdrawal of the instrument from the mouth were not included in the assessment. And we also measured the number of retchings and belchings depend on the location of the scope during the procedure and compared the mean frequencies of each events between two groups in each scope locations.

Statistics

We calculated the appropriate sample size for our study using the formula of Fleiss⁶ and the results of a previous non-inferiority study.⁷ Prior data indicate that the probability of retching among controls is 0.29. If the true probability of retching among cases is 0.17, we concluded that the total subjects needed would be 192 cases and 192 controls to be able to reject the null hypothesis that the retching rates for cases and controls are equal with a probability (power) of 0.8. The type I error associated with this test is 0.05.

All quantitative variables were reported as mean ± standard deviation and median with minimum–maximum values. All categorical variables were presented as frequency with % of the total. The non-parametric Student *t* test was used to compare the means of both groups. Pearson's chi-square and Fisher's exact test were used to compare the proportions of quantitative variables between the case and control groups.

To compare the mean frequencies of belching and retching according to the scope location between groups, we used a repeated measures ANOVA test with a post hoc test.

Multivariate logistic regression analysis with adjustment for age, sex, weight, sedation, prior endoscopy, and GI diseases was used to analyze the effect of lidocaine spray on the endpoints of retching and belching. Continuous variables were converted to dichotomous variables (frequency of events = 0 vs ≥ 1). For two-sided tests, *P* < 0.05 was considered statistically significant. All statistical analyses were performed with IBM SPSS Statistics 19.0 software (IBM Co., Armonk, NY, USA) and R version 3.0.2 (The R Foundation for Statistical Computing, Seoul, Korea).

Results

A total of 497 patients were enrolled in the study. Of these, 262 were assigned to the case group and 235 to the control group (Fig. 1). There were no significant differences between the groups with regard to age, sex, prior endoscopies, disease related symptoms, the proportion of sedation, endoscopy duration, biopsy, or diagnosis of GERD or PUD (Table 1). There were significant differences between groups in the mean frequency of retching and belching (*P*-value < 0.01; Fig. 2). A higher mean frequency of belching was observed when the endoscope was inserted into the esophagus, stomach antrum, and duodenum as opposed to other positions. The mean frequency of retching was highest as the endoscope passed into the esophagus. Higher mean frequencies of both retching and belching were found in the control group compared to the case group throughout the endoscopy.

To assess the impact of lidocaine spray on the endoscope tip to the outcomes of belching and retching, we converted the frequencies of these events into dichotomous variables and performed multivariate analysis with other confounding variables, regarding the tolerance using a logistic regression model (Table 2). In multivariate analysis, younger patients showed higher correlation with both of belching and retching. Patients within the control group

Fig. 1. Schematic flow diagram of the patient enrollment process and results. Case, lidocaine spray on endoscope in addition to conventional pharyngeal anesthesia; Control, conventional pharyngeal anesthesia without additional anesthesia.

Table 1 Baseline Characteristics between Case and Control Group

Characteristic		Case (n = 262)	Control (n = 235)	Total (n = 497)	P-value
Age (yr)		56.5 ± 14.6 (16–89)	56.3 ± 13.1 (19–88)	56.5 ± 14.3 (14–89)	0.874
Sex	Male	122 (46.6)	102 (43.4)	224 (45.1)	0.480
	Female	140 (53.4)	133 (56.6)	273 (54.9)	
Prior endoscopy experience	Yes	223 (85.1)	193 (82.1)	416 (83.7)	0.426
	No	39 (14.9)	41 (17.4)	80 (16.1)	
Symptoms*	Yes	119 (45.4)	101 (43.0)	220 (44.3)	0.613
	No	143 (54.6)	133 (56.6)	276 (55.5)	
Sedation	Yes	80 (30.5)	78 (33.2)	158 (31.8)	0.564
	No	180 (68.7)	157 (66.8)	337 (67.8)	
Endoscopy time (min) [†]		4.2 ± 2.3 (0.9–18.0)	4.1 ± 1.5 (1.4–14.2)	4.2 ± 2.0 (0.9–18.0)	0.781
Retching		0.8 ± 1.3 (0–8)	2.2 ± 2.4 (0–15)	1.5 ± 2.0 (0–15)	< 0.001
Belching		1.4 ± 2.1 (0–11)	4.5 ± 3.6 (0–18)	2.9 ± 3.3 (0–18)	< 0.001
Biopsy	Yes	78 (29.8)	66 (28.1)	144 (29.0)	0.733
	No	180 (68.7)	163 (69.4)	343 (69.0)	
GERD	Yes	109 (42.2)	95 (41.5)	204 (41.9)	0.865
	No	149 (57.8)	134 (58.5)	283 (58.1)	
PUD	Yes	36 (14.0)	30 (13.1)	66 (13.6)	0.785
	No	222 (86.0)	199 (86.9)	421 (86.4)	

Values are presented as mean ± standard deviation (range) or number (raw %).

Some variables showed different total number with other variables because of missing data or incorrect record.

GERD, gastro-esophageal reflux disease; PUD, peptic ulcer disease.

*Symptoms related upper gastrointestinal dysfunction, such as, epigastric pain, regurgitation, bloating, etc.

[†]Endoscopic time was defined from insertion of endoscope to withdrawal from the mouth of patients.

and female patients had higher levels of belching (control vs case group, odds ratio [OR] = 0.15, 95% confidence interval [CI] = 0.09–0.24, $P < 0.01$; female vs male, OR = 2.16, 95% CI = 1.40–3.33, $P = 0.01$). Patients within the control group and non-sedated

patients had higher levels of retching and there was a borderline significant correlation between a diagnosis of GERD and higher levels of retching (control vs case group, OR = 0.22, 95% CI = 0.15–0.34, $P < 0.01$; sedation vs non-sedation, OR = 0.39, 95% CI

Fig. 2. Mean frequencies of belching and retching in both case and control groups depending upon scope location ($P < 0.01$). Case, lidocaine spray on endoscope in addition to conventional pharyngeal anesthesia; Control, conventional pharyngeal anesthesia without additional anesthesia. Bi, belching during endoscopy of upper esophageal sphincter; Bei, belching during esophagus insertion; Bai, belching during antrum insertion; Bdi, belching during duodenal insertion; Bdw, belching during duodenal withdrawal; Baw, belching during antrum withdrawal; Bri, belching during retroversion and pulling; Brw, belching during retroversion pushing; Bfw, belching during fundus withdrawal; Bew, belching during esophageal withdrawal; Ri, retching during endoscopy of upper esophageal sphincter; Rei, retching during esophagus insertion; Rai, retching during antrum insertion; Rdi, retching during duodenal insertion; Rdw, retching during duodenal withdrawal; Raw, retching during antrum withdrawal; Rri, retching during retroversion and pulling; Rrw, retching during retroversion pushing; Rfw, retching during fundus withdrawal; Rew, retching during esophageal withdrawal.

Table 2 Multivariate Analysis of the Factors Contributing Two Primary Outcomes of Endoscopy Tolerance Using Logistic Regression Model ($n = 497$)

Variable		Number	% of belching	Unadjusted			Adjusted		
				OR	95% CI	P-value	OR	95% CI	P-value
Presence of belching									
Age	Numeric scale						0.96	0.94–0.98	< 0.01
Sex	Female	186	59.6	1.21	1.05–1.39	0.006	2.16	1.40–3.33	0.01
	Male	126	40.4						
Groups	Case*	120	46.1	0.55	0.48–0.69	< 0.01	0.15	0.09–0.24	< 0.01
	Control	192	83.1						
Prior endoscopy experience	Yes	261	83.7	0.98	0.82–1.71	0.82	0.81	0.45–1.45	0.48
	No	51	16.3						
Sedation	Yes	99	63.9	1.01	0.88–1.17	0.87	1.16	0.74–1.81	0.53
	No	212	63.1						
Endoscopy time	Numeric scale						1.07	0.97–1.19	0.19
GERD	Yes	132	65.0	1.04	0.91–1.19	0.56	1.22	0.81–1.89	0.34
	No	176	62.4						
Presence of retching									
Age	Numeric scale						0.22	0.15–0.34	< 0.01
Sex	Female	167	61.6	1.05	0.91–1.22	0.59	1.27	0.84–1.91	0.26
	Male	130	58.6						
Groups	Case*	119	45.6	0.59	0.51–0.69	< 0.01	0.22	0.15–0.34	< 0.01
	Control	178	77.1						
Prior endoscopy	Yes	249	60.3	0.99	0.82–1.20	0.94	0.87	0.50–1.51	0.62
	No	48	60.8						
Sedation	Yes	72	46.5	0.69	0.58–0.84	< 0.01	0.39	0.25–0.61	< 0.01
	No	225	67.1						
Endoscopy time	Numeric scale						1.05	0.95–1.17	0.33
GERD	Yes	133	65.5	1.16	1.01–1.34	0.04	1.48	1.00–2.21	0.06
	No	159	56.4						

Some variables showed different total number with other variables because of missing data or incorrect record.

OR, odds ratio; CI, confidence interval; GERD, gastro-esophageal reflux disease.

*Lidocaine spray was added on the tip of the endoscope before intubation among case group. Others with conventional pharyngeal anesthesia without lidocaine spray on the endoscope.

= 0.25–0.61, $P < 0.01$; GERD vs non-GERD, OR = 1.48, 95% CI = 1.00–2.21, $P = 0.06$).

Discussion

Pharyngeal anesthesia has been routinely used during endoscopy worldwide for many years, but its efficacy at improving tolerance to endoscopy has not been definitively proven. Many studies have shown a beneficial effect of pharyngeal anesthesia in terms of patient tolerance to UGIE,^{2,7–11} but other studies reported no benefits to either the patient or the endoscopist.^{12–15} A meta-analysis published in 2006 summarized these trials and concluded that pharyngeal anesthesia before endoscopy improves the ease of endoscopy and patient tolerance.¹⁶ However, many trials included in the study were conducted on sedated subjects and the estimation of tolerance to endoscopy was relatively subjective.

We tried to assess whether lidocaine sprayed on the endoscope would improve patient tolerance to endoscopy compared to conventional pharyngeal anesthesia alone by measuring specific, quantifiable endpoints, namely belching and retching. These events can impact the patient's tolerance to endoscopy, the examination quality, and the duration of the procedure. There were statistically significant differences in the frequency of retching and belching when comparing cases and controls using both univariate and multivariate analyses. We considered that these results were due to additional anesthesia at sites that were not anesthetized using the conventional method of pharyngeal anesthesia. There are more than five known gag reflex centers and use of either oral anesthetic spray or gargling anesthesia within the oral cavity does not effectively deliver anesthesia to all centers.¹⁷ Our new method of spraying lidocaine on the endoscope tip may effectively deliver the medication to deeper reflex centers.

Younger patients and female patients had a higher incidence of belching and retching in the present study compared to older and male patients. These findings are in concordance with previously published reports.¹⁰ Patients with GERD were also more susceptible to retching compared to those who did not have GERD.

No cases of methemoglobinemia or aspiration pneumonia were observed in our study. Severe methemoglobinemia has been reported in 3 previous cases,^{18–20} but typically as a result of using benzocaine as opposed to lidocaine.

There are some limitations to this study. Firstly, we did not consider the effect of patient anxiety. Secondly, since all endoscopies were performed by a single endoscopist, generalization of these results requires caution. As standardization of endoscopy is difficult, there was a single operator in our study to avoid discrepancy. In spite of these limitations, this is the first attempt to assess the benefit of lidocaine spray onto the endoscope tip to improve endoscopy tolerance by reducing belching and retching during the procedure.

We conclude that lidocaine spray on the endoscope tip in ad-

dition to conventional pharyngeal anesthesia can improve patient tolerance to UGIE compared to pharyngeal anesthesia alone. Further well-designed, randomized, controlled, double blinded trials are necessary to confirm these results.

Conflicts of Interest

No potential conflict of interest relevant to this article was reported.

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