

## Room for Quality Improvement in Endoscopist-Directed Sedation: Results from the First Nationwide Survey in Korea

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**Background/Aims:** This study sought to characterize the current sedation practices of Korean endoscopists in real-world settings. **Methods:** All active members of the Korean Society of Gastrointestinal Endoscopy were invited to complete an anonymous 35-item questionnaire. **Results:** The overall response rate was 22.7% (1,332/5,860). Propofol-based sedation was the dominant method used in both elective esophagogastroduodenoscopy (55.6%) and colonoscopy (52.6%). The mean satisfaction score for propofol-based sedation was significantly higher than that for standard sedation in both examinations (all  $p < 0.001$ ). The use of propofol was supervised exclusively by endoscopists (98.6%). Endoscopists practicing in nonacademic settings, gastroenterologists, or endoscopists with  $< 10$  years of endoscopic practice were more likely to use propofol than were their counterparts (all  $p < 0.001$ ). In total, 27.3% of all respondents performed sedation practices without having undergone sedation training, and 27.4% did so without any formal sedation protocols. The choice of propofol as the dominant sedation method was the only significant predictor of endoscopist experience with serious sedation-related adverse events (odds ratio, 1.854; 95% confidence interval, 1.414 to 2.432). **Conclusions:** Endoscopist-directed propofol administration is the predominant sedation method used in Korea. This survey strongly suggests that there is much room for quality improvement regarding sedation training and patient vigilance in endoscopist-directed sedation. (*Gut Liver* 2016;10:83-94)

**Key Words:** Gastrointestinal endoscopy; Sedation; Health

care surveys; Propofol; Non-anesthesiologist-administered propofol

### INTRODUCTION

Endoscopic sedation has become an integral part of modern gastrointestinal (GI) endoscopy. It provides better patient satisfaction and compliance with endoscopic procedures; thus, it can facilitate endoscopist performance of safe and effective procedures with patient cooperation.<sup>1,2</sup> The increasing need for minimally invasive endoscopic procedures and screening endoscopy is also expected to increase the demand for procedural sedation.<sup>3,4</sup> However, sedation in GI endoscopy is accompanied by several drawbacks, such as additional time for patient recovery, increased healthcare costs, and a substantial risk of cardiopulmonary complications.<sup>2,5</sup> Additionally, there is continuing debate about who should be responsible for the administration of sedatives, especially propofol. Although increasing evidence has suggested that endoscopist-directed propofol (EDP) can be used safely in elective GI endoscopy for healthy individuals,<sup>6-10</sup> non-anesthesiologist-administered propofol sedation is still disputed by anesthesia specialists who argue that propofol should be administered only by persons trained in general anesthesia.<sup>11-13</sup> Moreover, the cost-effectiveness of monitored anesthesia care in low-risk patients has not yet been evaluated sufficiently.<sup>14-16</sup> Regardless of these continuing debates, the use of EDP is expected to increase steadily worldwide.

Currently, there is wide variation among sedation and concomitant monitoring practices for GI endoscopy, according to

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endoscopists' preferences, resources of the healthcare facility, local policies, and national legal restrictions.<sup>17</sup> Previous surveys of sedation practice patterns of endoscopists have shown worldwide variation in terms of rates of sedation, preferred sedation regimens, and patient monitoring practices, such as the routine use of pulse oximetry.<sup>18-25</sup> Despite many studies, some critical questions remain. For example, what are the characteristics of endoscopists who prefer propofol to standard sedation using midazolam and/or opioids? How often do endoscopists follow the quality guidelines for sedation practice, such as preprocedural risk stratification of patients and appropriate training in endoscopic sedation? How many endoscopists have experience with serious adverse events (SAEs) related to sedation in their practices?

Given this background, we conducted a nationwide survey to assess current practices of sedation and concomitant patient monitoring for routine GI endoscopy among Korean endoscopists. Because there is limited evidence on sedation practice patterns among Asian endoscopists, we believe that our data reflecting endoscopists' real-life practices could be a useful source to impact quality improvement in patient care, the provision of proper training programs, and, potentially, policy-making for endoscopic sedation.

## MATERIALS AND METHODS

### 1. Study population and design

This study was a cross-sectional web survey conducted in August 2014 among endoscopists who were active members of the Korean Society for Gastrointestinal Endoscopy (KSGE). All active members of the KSGE who were identified from the KSGE database were invited by email to participate. Survey participants completed an anonymous survey via a dedicated website linked to an email. All completed data were transferred via the web to a central database. All data remained anonymous to study investigators.

### 2. Ethical considerations

This study was conducted according to the Declaration of Helsinki and was approved by the Institutional Review Board of Kyung Hee University Hospital (KMC-IRB 1423-01). The study was registered at the clinical research information service (<http://cris.nih.go.kr/>; registration number: KCT0001171). All authors reviewed and approved the final manuscript.

### 3. Development and contents of survey items

A five-section, 35-item questionnaire was developed by expert members of the KSGE Task Force on Endoscopic Sedation (Appendix 1). Briefly, the first section consisted of demographics and basic characteristics of the respondents, including the endoscopist's specialty, years of endoscopic practice, practice environment (primary clinic, nonacademic community hospital,

and academic teaching hospital), number of weekly procedures, and type of endoscopic practice (esophagogastroduodenoscopy [EGD] only, colonoscopy only, or both). The second section addressed the endoscopists' dominant sedation method used and their satisfaction with it, rated by 10-point visual analog scale (VAS), and the number of staff present during the sedation practice. The third section was targeted at the responsibility for and actual delivery of propofol and the potential reasons for not using propofol, if indicated. The fourth section regarding monitoring practices addressed the use of preprocedural assessments, using the American Society of Anesthesiologists (ASA) physical status classification, a formal sedation protocol, and patient vigilance, including pulse oximetry and supplemental oxygen.<sup>26</sup> We also inquired about the endoscopists' experiences with sedation-related SAEs during their practice, predefined as

**Table 1.** Demographics of Survey Respondents

Characteristic	Value
No. of respondents	1,332 (22.7)
Male sex	1,068 (80.2)
Age, yr	43.4 (28.0–80.0)
Practice environment	
Private clinic	599 (45.0)
Nonacademic hospital	349 (26.2)
Academic teaching hospital	372 (27.9)
Others	12 (0.9)
Specialty	
Gastroenterologist	1,097 (82.4)
General internist	172 (12.9)
Surgeon	36 (2.7)
Pediatrician	23 (1.7)
Others	4 (0.3)
Years of endoscopy practice	
<5	334 (25.1)
5–10	380 (28.5)
11–15	231 (17.3)
>15	387 (29.1)
Type of endoscopic practice	
Esophagogastroduodenoscopy	136 (10.2)
Colonoscopy	22 (1.7)
Both	1,174 (88.1)
No. of endoscopy cases per week	
<20	274 (20.6)
20–50	459 (34.5)
51–100	377 (28.3)
>100	222 (16.7)
Current use of sedation for gastrointestinal endoscopy, if any	1,318 (98.9)

Data are presented as number (%) or mean (range).

mask ventilation, endotracheal intubation, permanent injury, or death. The final section addressed training in endoscopic sedation.

#### 4. Statistical analysis

We analyzed the data first using descriptive statistics. Then, we performed the chi-square test to assess differences in proportions. Student t-test was used to assess differences between means, such as the endoscopists' satisfaction scores rated by the VAS. Finally, we performed a logistic regression analysis to identify potential predictors of endoscopist experience with sedation-related SAEs, after adjustment for potential confounders, including the respondent's age and gender, specialty, practice environment, type and burden of endoscopic procedures, years of endoscopic practice, dominant sedation method, use of the ASA categories for preprocedural assessment or a formal sedation protocol, use of pulse oximetry or supplemental oxygen, and completion of dedicated sedation training. Factors with a p-value <0.2 in the univariate analysis were included in the stepwise regression analysis. A p-value <0.05 was considered to indicate statistical significance. All data were analyzed using SPSS version 18.0K for windows (SPSS Korea Inc., Seoul, Korea).

## RESULTS

### 1. Characteristics of the study respondents

The demographic characteristics of the study respondents are summarized in Table 1. In total, 1,332 of the 5,860 KSGE members invited completed the survey, an overall response rate of 22.7%. The mean age of the respondents was 43.4 years; 80.2% were men, and 82.4% were gastroenterologists. Of the respondents, 46% currently practiced at a primary clinic, 26.2% at a nonacademic hospital, and 27.9% at an academic teaching hospital. Of the respondents, 46.4% had  $\geq 10$  years of endoscopic practice, 88% currently performed both EGD and colonoscopy, and 79.4% performed  $\geq 20$  endoscopies per week.

### 2. Dominant sedation method and endoscopists' satisfaction

The vast majority of respondents (98.9%, 1,318/1,332) currently offer procedural sedation for diagnostic EGD (99.1%) and colonoscopy (91.4%). The detailed proportions of sedation use in EGD and colonoscopy are summarized in Table 2. Propofol-based sedation (propofol alone or in combination with midazolam and/or an opioid) was the most preferred sedation method for both EGD and colonoscopy (55.6% and 52.6%, respectively). Regarding endoscopists' satisfaction with their primary sedation method, the mean (standard deviation) satisfaction score for

**Table 2.** The Use of Sedation in Elective Esophagogastroduodenoscopy and Colonoscopy

Variable	EGD	Colonoscopy
Current use of sedation, if any	1,305 (99.0)	1,205 (91.4)
Proportion of sedated endoscopy		
<25% of cases	124 (9.5)	19 (1.6)
26%–50% of cases	298 (22.8)	57 (4.7)
51%–75% of cases	474 (36.3)	188 (15.6)
>76% of cases	409 (31.3)	941 (78.1)
Endoscopists' choice		
Midazolam $\pm$ opioid	483 (37.0)/54 (4.1)	185 (15.4)/360 (29.9)
Propofol $\pm$ opioid	378 (29.0)/2 (0.2)	72 (6.0)/13 (1.1)
Propofol+midazolam $\pm$ opioid	330 (25.3)/15 (1.1)	407 (33.8)/143 (11.9)
Others	43 (3.3)	25 (2.1)
Overall endoscopists' satisfaction with sedation		
9–10	339 (26.0)	457 (37.9)
7–8	688 (52.7)	577 (47.9)
5–6	191 (14.6)	129 (10.7)
$\leq 4$	87 (6.7)	42 (3.5)
Staffing in endoscopic sedation*		
One nurse <sup>†</sup>		417 (31.6)
Two nurses <sup>†</sup>		813 (61.7)
One assisting physician and $\geq 1$ nurse <sup>†</sup>		88 (6.7)

Data are presented as number (%).

EGD, esophagogastroduodenoscopy.

\*Except for endoscopist; <sup>†</sup>Trained registered or licensed practical nurse.

propofol-based sedation was significantly higher than that for standard sedation (7.99 [1.29] vs 6.60 [1.78] for EGD; 8.24 [1.23] vs 7.45 [1.64] for colonoscopy, respectively; all  $p < 0.001$ ). More than half (61.7%) worked with two trained nurses (registered or licensed practical nurses) for sedated endoscopy.

### 3. Propofol sedation

Of the respondents, 63% (830/1,318) of respondents currently used propofol with good satisfaction ratings: 91.1% rated 7 points or more on a VAS. Use of propofol was almost always

directed by endoscopists (98.6%), but delivery of the drug was performed mostly by trained nurses (88.5%) (Table 3). Endoscopists practicing in nonacademic settings, gastroenterologists, or endoscopists with <10 years of practice were more likely to use propofol than were endoscopists work in an academic hospital, nongastroenterologists, or endoscopists with  $\geq 10$  years of practice (67.7% vs 50.9%, 65.8% vs 49.1%, and 71.8% vs 52.7%, respectively; all  $p < 0.001$ ) (Fig. 1). The fear of cardiopulmonary side effects was the most common reason cited for not currently using propofol (50.0%, 244/488).

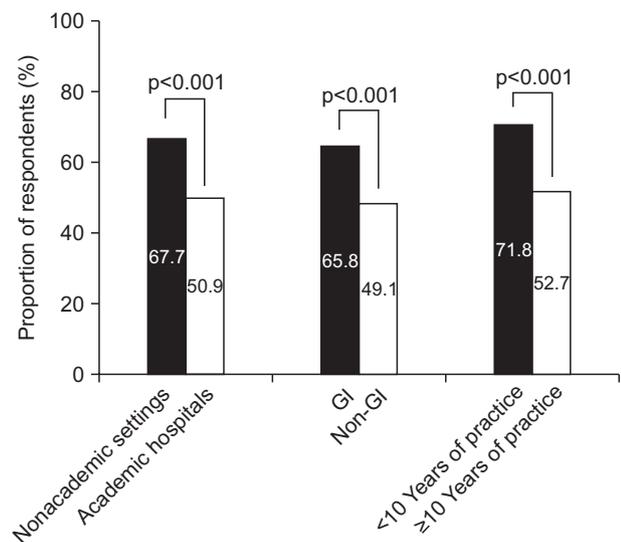
### 4. Concurrent monitoring practices

The majority of respondents (94.1%, 1,240/1,318) always or usually monitored pulse oximetry, and 42.5% (560/1,318) always or usually administered supplemental oxygen during sedated endoscopy (Fig. 2). Compared with their counterparts, endoscopists practicing at an academic hospital, gastroenterologists, and endoscopists with <10 years of practice were more likely to use pulse oximetry or supplemental oxygen (all  $p < 0.001$ ) (Table 4). Of the respondents, 38.3% of respondents rarely or never performed risk stratification using the ASA categories prior to providing sedation. Endoscopists practicing at an academic hospital were more likely to use ASA categories than were endoscopists practicing in nonacademic settings (74.7% vs 56.6%,  $p < 0.001$ ), but this finding was not associated with the endoscopists' specialty or years of endoscopic practice. Of the respondents, 27.4% (361/1,318) provided sedatives using no formal sedation protocol. Endoscopists practicing in nonacademic settings and nongastroenterologists were more likely not

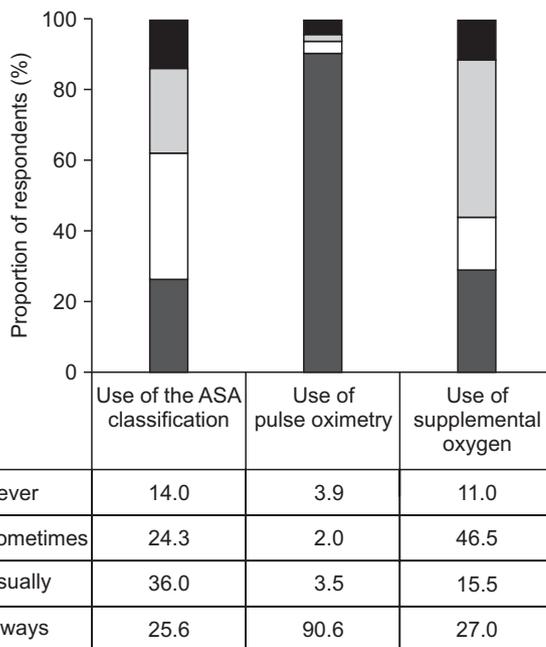
**Table 3.** Practice Patterns for the Use of Propofol (n=830)

Variable	No. (%)
Supervision for the use of propofol	
By endoscopist	818 (98.6)
By assisting nonanesthesiologist physician	3 (0.4)
By anesthesiologist	2 (0.2)
By endoscopy nurse*	7 (0.8)
Administration (delivery) of propofol	
By endoscopist	80 (9.6)
By assisting physician	13 (1.6)
By anesthesiologist	2 (0.2)
By endoscopy nurse*	735 (88.5)
Overall satisfaction score <sup>†</sup>	
9-10	336 (40.5)
7-8	420 (50.6)
5-6	54 (6.5)
$\leq 4$	20 (2.4)

\*Trained registered or licensed practical nurse; <sup>†</sup>Measured on a 10-point visual analog scale.



**Fig. 1.** The characteristics of respondents who chose propofol as the dominant sedation method. GI, gastrointestinal.



**Fig. 2.** Practice patterns regarding concomitant patient monitoring. ASA, American Society of Anesthesiologists.

**Table 4.** Patient Monitoring Practices

	Nonacademic settings	Academic hospitals	p-value	GI	Non-GI	p-value	<10 Years of practice	≥10 Years of practice	p-value
ASA category*, %	56.6	74.8	<0.001	62.6	57.1	0.073	59.9	63.7	0.089
Pulse oximetry*, %	91.8	100.0	<0.001	97.2	79.9	<0.001	99.3	88.0	<0.001
Supplemental oxygen*, %	38.6	52.6	<0.001	44.6	32.1	<0.001	47.1	37.1	<0.001
Sedation protocol	64.4	93.8	<0.001	75.1	60.3	<0.001	72.1	73.2	0.665

GI, gastrointestinal; ASA, American Society of Anesthesiologists.

\*Proportion of respondents who always or usually used.

to use a formal sedation protocol, when compared with their counterparts (35.6% vs 6.2%, 39.7% vs 24.9%, respectively; all  $p < 0.001$ ).

Regarding SAEs, 65.4% (814/1,318) of respondents stated they had experience with one of the four predefined SAEs during their own life-time practice: mask ventilation in 61.8%, endotracheal intubation in 16.2%, permanent injury in 1.4%, and death in 1.7%. The choice of propofol as the dominant sedation method was the only significant predictor of endoscopist experience with sedation-related SAEs (odds ratio, 1.854; 95% confidence interval, 1.414 to 2.432;  $p < 0.001$ ), after adjusting for potential confounders.

### 5. Sedation training

Respondents stated that they received dedicated sedation training at their training hospital (30.1%) or continuing education programs by professional organizations (18.4%), or both (42.6%). However, 8.9% of all respondents had not received any training or education regarding sedation practices. Among gastroenterologists, 20.1% (220/1,097) did not receive dedicated training for sedation during their GI fellowship. More than half of respondents (54.3%) agreed that assessment of competence is required following specialized training or education for endoscopic sedation. Finally, 45.4% of respondents stated that periodic retraining on basic life support techniques was not enforced for all medical personnel involved in sedation practices within their unit.

## DISCUSSION

This nationwide survey of 1,332 endoscopists demonstrated that endoscopist-directed, nurse-administered propofol is currently the dominant sedation method used in routine GI endoscopy in Korea. Although many previous surveys have reported that "standard" sedation using midazolam and/or opioids still prevails among most Western endoscopists for routine endoscopy, a recent survey in Spain showed that propofol has become increasingly accepted as the dominant sedative in GI endoscopy.<sup>18-25</sup> In our study, the preference for propofol by endoscopists was associated with the endoscopist's specialty (gastroenterologist), practice environment (nonacademic setting), and years of

endoscopic practice (<10 years of practice). These findings are consistent with our expectations to some extent. First, propofol is a highly attractive sedative for endoscopists due to its proven efficacy in GI endoscopy. Previous studies have consistently reported that compared with standard sedation, propofol sedation during routine GI endoscopy provides better patient satisfaction with no increase in adverse events in healthy individuals.<sup>1,2,5,6</sup> As demonstrated in this survey, propofol sedation also provided better endoscopist satisfaction than did standard sedation, consistent with previous surveys of Western endoscopists.<sup>18-25</sup> In addition, the use of propofol for procedural sedation is freely permitted for nonanesthesiologists in Korea. With recent increased use and the subsequent popularity of propofol, training in EDP is more integrated as a basic course during fellowships in gastroenterology for Korean trainees. Thus, we assumed that gastroenterologists who had completed fellowships recently would prefer propofol over standard sedation.

It also seems likely that operating efficiency may be a possible explanation for why propofol was preferred by endoscopists practicing in nonacademic settings, where available resources are expected to be more limited than those at an academic hospital. Therefore, the pharmacokinetics of propofol, such as its rapid onset of action and shorter recovery time, are presumed to be a potential factor influencing an endoscopist's decision on sedative use. In fact, recent meta-analyses have suggested that propofol sedation can affect endoscopy unit efficiency without compromising patient care during GI endoscopy.<sup>27,28</sup> One survey of endoscopists in the United States reported findings similar to ours.<sup>29</sup> In that study, community practitioners were more likely to use propofol than those at academic centers, regardless of the procedure (EGD, colonoscopy, or endoscopic ultrasonography/endoscopic retrograde cholangiopancreatography).<sup>29</sup> However, there appears to be some regional variation associated with the preference for propofol by Korean endoscopists, which may be due partly to limited resources at anesthesiology services and partly to lower reimbursement for sedation practices.

Appropriate training of endoscopists who are responsible for the administration of sedation is the first step to guarantee patient safety during endoscopic sedation. Thus, current guidelines recommend that healthcare providers who plan to administer sedation should receive proper training in procedural sedation

prior to the beginning of their own practice.<sup>2,6,30</sup> Our study demonstrated that 72.7% of respondents received dedicated training in endoscopic sedation, whereas 18.4% received only continuing educational programs by professional organizations, and 8.9% depended only on self-directed learning. Interestingly, 20.1% of Korean gastroenterologists did not receive dedicated training in endoscopic sedation during their fellowship. Likewise, a recent study in the United Kingdom reported that 51% of gastroenterology trainees did not receive structural training in safe sedation.<sup>31</sup> Those findings, including ours, provide several important suggestions regarding the provision of educational programs for endoscopic sedation. First, a dedicated training course on endoscopic sedation should be provided for trainees in gastroenterology during fellowships. Additionally, professional GI societies should offer more structured educational programs, including hands-on skills, for endoscopists who are not trained in endoscopic sedation, given that continuous educational programs generally consist of didactic lectures only. In this study, more than half of respondents (54.3%) stated that an assessment of competence should be required following specialized training or education for endoscopic sedation. These attitudes are aligned with current guidelines recommending assessment of competency following completion of training courses.<sup>32,33</sup>

Our study also raises other sedation quality issues related to patient vigilance. First, a substantial proportion of respondents (38.3%) stated that they had never or only sometimes used the ASA classification for preprocedural assessment. An anesthesiology service is generally recommended for endoscopic sedation of patients with a higher ASA category who are believed to have definite patient-related risk factors for complications.<sup>2,6,30</sup> Thus, stratification by established methods, such as ASA category, is now recommended as an important quality indicator for all GI endoscopic procedures.<sup>34</sup> In addition, 27.4% of respondents stated that they performed sedation practice with no formal sedation protocol. Even if sedation practice is highly variable according to endoscopists, the use of a formal sedation protocol is required for standardization of patient care. In this regard, a recent study conducted in Germany provides important evidence suggesting that quality can be improved significantly by implementation of appropriate quality measures.<sup>35</sup> In a study surveying 4,405 members of the German Society of Digestive and Metabolic Diseases, patient monitoring practices during endoscopic sedation were clearly improved by the 3-year implementation of national sedation guidelines for GI endoscopy.<sup>35</sup> We believe that our study provides a rationale for the development of national guidelines on sedation during GI endoscopy.

One of several interesting findings in this study is that a large number of endoscopists have experience in serious respiratory depression requiring airway rescue in their own practice (mask ventilation in 61.8%, endotracheal intubation in 16.2%). Respiratory depression is the most common serious, potentially

life-threatening complication related to sedation, regardless of the type of sedative or analgesic.<sup>2,30</sup> Despite numerous studies demonstrating the safety of endoscopic sedation, especially EDP, most results were obtained from randomized controlled trials or large nonrandomized case series, rather than a real-life clinical setting.<sup>1,6-10,27,28</sup> In this regard, our current findings suggest that the incidence of serious respiratory events during endoscopic sedation is underestimated in real-life settings. In fact, the proportion of endoscopists who had experience in serious respiratory events in this study was much higher than our expectations. Although we could not quantify the usual depth of sedation, we assumed that most endoscopists might use moderate sedation, because our survey focused on elective EGD and colonoscopy. In addition, the reported rates of pulse oximetry (94.1%) and supplemental oxygen (42.5%) use in the present study are generally comparable with those of previous sedation surveys reported in Europe and North America, ranging from 77% to 100% for pulse oximetry use and from 34.0% to 72.7% for supplemental oxygen use.<sup>18-25</sup> Ultimately, our findings support the importance of airway management in the provision of educational programs for sedation training. We also believe that all medical personnel involved in endoscopic sedation should undergo periodic retraining in airway management, given that actual delivery of the sedatives was performed mostly by endoscopy nurses in this study.

The use of propofol as a preferred sedation method was the only significant predictor of endoscopist experience with sedation-related SAEs in the current study. However, this finding should be interpreted carefully, given that the survey was not intended to calculate the actual incidences of adverse events related to propofol-based sedation. As stated above, numerous studies have consistently shown that propofol sedation presents similar rates of adverse events, provides higher patient and physician satisfaction, and decreases procedure and recovery times, when compared with standard sedation.<sup>1,2,5,6,27,28</sup> In addition, there is accumulating evidence that EDP can be used safely and effectively for healthy individuals in elective GI endoscopy.<sup>6-10,27,28</sup> A recent large prospective study evaluating 10,000 patients who underwent endoscopic procedures also confirmed that EDP in an outpatient setting is a safe procedure among patients without severe comorbidities.<sup>9</sup> Given the different practice settings among countries, we believe that a future prospective cohort study is required to evaluate the safety of EDP in Korea.

This study has several limitations. First, it was a cross-sectional analysis using a self-reported survey, so recall bias could be an issue. Although we maintained the anonymity of respondents, further prospective cohort studies are required to deal with sensitive issues such as the endoscopist's experience with SAEs related to sedation in real-life settings. Second, the final response rate was low (22.7%), so it may be argued that our data are not representative of the entire population of Korean endoscopists. Given the large number of respondents who com-

pleted the survey, however, we believe that our data adequately reflect current sedation practice in Korea. Finally, we did not survey some important quality issues in endoscopic sedation, such as informed consent and documentation of sedation practices.<sup>33</sup> In a study analyzing anesthesia-related medical disputes during a 6-year period in Korea, lack of records on evaluation pre- and during anesthesia were reported in 92.3% and 89.7%, respectively, among 39 sedation cases with medical disputes.<sup>13</sup> A recently published guideline for quality indicators common to all GI endoscopic procedures also highlights that formal documentation is essential for the entire endoscopic sedation process, including a sedation plan, risk assessment of patients before sedation, patient monitoring during sedation, and the use of reversal agents if indicated.<sup>34</sup> We believe that this is an important topic for quality improvement in endoscopic sedation.

In conclusion, the present nationwide study reveals that endoscopist-directed, nurse-administered propofol has become standard practice for endoscopic sedation in Korea. The preference for propofol is currently headed by endoscopists practicing in nonacademic settings, gastroenterologists, or endoscopists with <10 years of endoscopic practice. However, this study strongly suggests there is much room for quality improvement in endoscopist-directed sedation, especially in sedation training and patient vigilance. Given the current results regarding sedation-related SAEs, we believe that expertise in airway rescue techniques should become a key priority in training and continuing educational programs for endoscopic sedation.

## CONFLICTS OF INTEREST

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

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**Appendix 1.** Sedation Survey Questionnaire**Part I. Demographics of survey respondents**

1) Sex

- ① Male
- ② Female

2) Age: (                    ) years

3) Practice environment

- ① Primary clinic
- ② Nonacademic hospital
- ③ Academic teaching hospital
- ④ Others

4) What is your specialty?

- ① Gastroenterologist
- ② General internist
- ③ Surgeon
- ④ Pediatrician
- ⑤ Others

5) How long have you performed endoscopy (years of endoscopic practice)?

- ① <5 years
- ② 5–10 years
- ③ 10–15 years
- ④ >15 years

6) What kind of endoscopy do you currently perform in your practice?

- ① Esophagogastroduodenoscopy (EGD)
- ② Colonoscopy
- ③ Both

7) How many endoscopy cases do you usually perform in your practice?

- ① <20 cases
- ② 20–50 cases
- ③ 50–100 cases
- ④ >100 cases

8) Do you currently provide procedural sedation for elective gastrointestinal (GI) endoscopy (EGD or colonoscopy)?

- ① Yes
- ② No ( → Jump to question 32)

**Part II. Use of sedation in elective EGD and colonoscopy**

9) Do you currently offer sedation for EGD?

- ① Yes
- ② No ( → Jump to question 13)

10) How often do you offer sedation for EGD?

- ① <25% of cases
- ② 26%–50% of cases
- ③ 51%–75% of cases
- ④ >76% of cases

11) What kind of sedative(s) is (are) the drug(s) that you prefer for sedated EGD?

- ① Midazolam±opioid
- ② Propofol±opioid
- ③ Propofol+midazolam±opioid
- ④ Others

12) Rate your overall satisfaction with the sedative(s) that you prefer for sedated EGD, using a 10-point scale (0: unsatisfactory, 10: very satisfied): (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).

13) Do you currently offer sedation for colonoscopy?

- ① Yes
- ② No (Jump to question 17)

14) How often do you offer sedation for colonoscopy?

- ① <25% of cases
- ② 26%–50% of cases
- ③ 51%–75% of cases
- ④ >76% of cases

15) What kind of sedative(s) is (are) the drug(s) that you prefer for sedated colonoscopy?

- ① Midazolam±opioid
- ② Propofol±opioid
- ③ Propofol+midazolam±opioid
- ④ Others

16) Rate your overall satisfaction with the sedative(s) that you prefer for sedated colonoscopy, using a 10-point scale (0: unsatisfactory, 10: very satisfied): (0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10).

17) Who is responsible for administration of sedative(s) in your endoscopic practice?

- ① Endoscopist
- ② Assisting nonanesthesiologist physician
- ③ Anesthesiologist
- ④ Trained nurse (regular nurse or licensed practical nurse)

18) Who actually delivers the sedative(s) to patients in your endoscopic practice?

- ① Endoscopist
- ② Assisting nonanesthesiologist physician
- ③ Anesthesiologist
- ④ Trained nurse (regular nurse or licensed practical nurse)

19) How many staffs are involved in your sedation practice (other than the endoscopist)?

- ① One trained nurse
- ② Two trained nurses
- ③ One assisting physician and one or more nurses

**Part III. Practice patterns for the use of propofol**

20) Do you currently use propofol in your sedation practice?

- ① Yes
- ② No ( → Jump to question 24)

21) Who is responsible for the administration of propofol in your endoscopic practice?

- ① Endoscopist
- ② Assisting nonanesthesiologist physician
- ③ Anesthesiologist
- ④ Trained nurse (regular nurse or licensed practical nurse)

22) Who actually delivers propofol to patients in your endoscopic practice?

- ① Endoscopist
- ② Assisting nonanesthesiologist physician
- ③ Anesthesiologist
- ④ Trained nurse (regular nurse or licensed practical nurse)

23) Rate your overall satisfaction with propofol sedation, using 10-point scale (0: unsatisfactory, 10: very satisfied): (0,1,2,3,4,5,6,7,8,9,10).

24) What is the most important reason for not currently using propofol for sedated endoscopy?

- ① No need to use propofol
- ② Concerns regarding propofol-related adverse events
- ③ Shortage of manpower or lack of facilities
- ④ Regulation by the health authorities
- ⑤ Lack of education on and/or experience with propofol sedation
- ⑥ Others

**Part IV. Concomitant monitoring practices**

25) How often do you assess your patients using the American Society of Anesthesiologists (ASA) physical status classification, prior to providing sedation?

- ① Always
- ② Usually
- ③ Sometimes
- ④ Never

26) How often do you monitor oxygen saturation using pulse oximetry during sedated endoscopy?

- ① Always
- ② Usually
- ③ Sometimes
- ④ Never

27) How often do you provide supplemental oxygen during sedated endoscopy?

- ① Always
- ② Usually
- ③ Sometimes
- ④ Never

28) Are you equipped with an emergency cardiopulmonary resuscitation kit within your endoscopy unit?

- ① Yes
- ② No

29) Do you provide sedation using a formal sedation protocol?

- ① Yes
- ② No

30) Do you have any experience in sedation-related serious adverse events in your own endoscopic practice? (Indicate all of the following, if any)

- ① Mask ventilation (associated with serious respiratory depression)
- ② Endotracheal intubation (associated with serious respiratory depression)
- ③ Permanent injury
- ④ Death

#### **Part V. Sedation training**

31) Have you ever received training or education for sedation practice?

- ① Yes: a dedicated sedation training in a training hospital
- ② Yes: educational programs by professional organizations
- ③ Yes: both of above
- ④ None

32) Is periodic retraining of basic life support offered to all medical personnel who are involved in sedation practice within your endoscopy unit?

- ① Yes
- ② No

33) Do you think that competency assessment is required following completion of training or education for sedation practice?

- ① Yes
- ② No

34) Do you think that endoscopist-directed propofol sedation is safe and effective for healthy individuals during elective GI endoscopy?

- ① Yes
- ② No

35) Do you think that a national guideline for endoscopic sedation is required?

- ① Yes
- ② No