Impact of endoscopic sedation on gastric polyp detection: A one-center retrospective observational study

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Abstract
Sedation esophagogastroduodenoscopy (EGD) has become more prevalent in many countries. However, owing to the limitation of health insurance payment for sedation EGD in Taiwan, non-sedation EGD still accounts for the majority of cases. This study was aimed to explore the differences between the sedation and non-sedation groups in terms of endoscopic findings, such as detection rate of gastric polyp of any size, number of detected gastric polyps, and location of the gastric polyps detected.

We enrolled 10,940 patients who underwent EGD between January 1, 2016 and December 31, 2016 at the Tri-Service General Hospital; among the patients, 1900 received intravenous sedation (IVS) and 9040 did not. The data reviewed included demographics, parameters of the polyp (number, size, and location), and pathology.

Compared with the non-sedation group, the sedation group had a higher overall polyp detection rate ($P < .001$); a greater number of detected polyps (Odds ratio 1.50, $P = .007$); and a higher detection rate of smaller polyps, such as fundic gland polyp, and hyperplastic polyp ($P < .001$). Among the pathological findings, gastric neuroendocrine tumor (NET) was detected using EGD in 2 cases and manifested as small polyps (<0.05 cm), and it showed significantly better detection rates in the sedation EGD group than in the non-sedation EGD group ($P = .002$).

Sedation EGD could enhance a patients willingness and cooperation during EGD. Furthermore, sedation EGD increased the detection rates of small gastric polyps and was more likely to enable identification of unusual findings, such as gastric NET.

Abbreviations: EGD = esophagogastroduodenoscopy, IVS = intravenous sedation, NET = neuroendocrine tumor.

Keywords: esophagogastroduodenoscopy, gastric polyp, intravenous sedation, non-sedation

1. Introduction
Esophagogastroduodenoscopy (EGD) is an imperative procedure during health check-ups. EGD is used to examine individuals who are at a high risk of gastrointestinal diseases such as gastric ulcer, Barrets esophagus, and gastric cancer. Recent years have witnessed an increased emphasis on the quality of EGD procedure. Due to the awareness on preventive health care, the number of patients who agree to undergo EGD is higher than before. However, concerns about discomfort and unpleasant sensation caused by EGD under alert consciousness remain. In Western countries, sedation greatly assists in relieving anxiety and encourages patients to complete the EGD, which increases the quality of the examination. In East Asia, sedation is not routinely used during EGD, likely because of physician concerns on the risk and comorbidities during sedation. In fact, the prevalence rate of sedation EGD in Taiwan had been lower than that in Western countries. However, due to the development of several standardized steps, including type and dosage of medications, and improvement in skills on sedation during endoscopy, sedation EGD has become more prevalent in Taiwan in recent years.

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The authors declare that they have no competing interests.
All data generated or analyzed during this study are included in this published article [and its supplementary information files].
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During EGD, a common abnormal finding is the presence of gastric polyps, which are luminal lesions that arise from the epithelial or mucosal surface. Clinically, gastric polyps are always observed incidentally. However, some gastric polyps are related to other symptoms such as anemia, gastrointestinal bleeding, and gastric outlet obstruction.\(^{[4-6]}\) With the widespread use of endoscopy, the detection rate for gastric polyps has gradually increased to 2% to 5%.\(^{[7]}\) There are various kinds of gastric polyps, such as hyperplastic polyp, fundic gland polyp, inflammatory fibroid polyp, neuroendocrine tumor, gastric adenoma, adenocarcinoma, and gastrointestinal stromal tumor.

In this study, we were interested to find out the benefits of sedation during EGD, specifically the detection rate of gastric polyps of any size. Deep sedation was postulated to increase the detection rate of colonic adenoma and the number of detected polyps of any size. Deep sedation was postulated to increase the detection rate of colonic adenoma and the number of detected polyps of any size.\(^{[8]}\) This study is the first large-scale retrospective report on the relationship between gastric polyp detection and sedation/non-sedation during EGD. Moreover, we discussed about the parameters of gastric polyp surveillance in this study.

### 2. Materials and methods

#### 2.1. Patients

This observational study acquired data from patients who underwent EGD at the Tri-Service General Hospital between January 1, 2016 and December 31, 2016. The study was approved by the institutional review board of Tri-Service General Hospital (IRB: 1-106-05-154). The electronic medical records of all patients were searched for information, including demographics (age and sex), polyp number, and polyp location. We excluded patients with incomplete or duplicate reports. If the patient had more than one report during the study period, only the first report was considered. We excluded patients with unclear demographics (age and sex) and those who were younger than 18 years old.

#### 2.2. Endoscopic study

All enrolled patients underwent elective EGD at the Division of Gastroenterology of our hospital. All enrolled patients received information about intravenous sedation (IVS) and non-sedation EGD after discussion with the gastroenterologist in the outpatient department. All the enrolled patients were given the choice between IVS and non-sedation protocols and signed the informed consent before EGD. During the study period, all procedures in both groups were performed by the same physicians (i.e., gastroenterologists and anesthesiologists) and with the assistance of the same trained nurses. All the patients underwent EGD in the same room at the Division of Gastroenterology.

All enrolled patients had no acute illness, such as chronic obstructive pulmonary disease, chronic heart failure, recent myocardial infarction, and recent cerebrovascular accident in 6 months. During EGD, all patients received non-invasive continuous monitoring for blood pressure, heart rate, and oxygen saturation. In the sedated patients, the standard sedative protocol was as follows. The patients were confirmed as low risk (ASA I or II) after anesthesia assessment. At the beginning of EGD, the trained nurse administered pre-medications with fentanyl as a single bolus of 0.5 to 1.5 mcg/kg and midazolam as a bolus dose of 2.5 mg, with an average given dose of 3.5 to 7.5 mg. Under the supervision of the anesthesiologists, the trained nurses administered target-controlled propofol infusion. In all patients, the level of consciousness was checked by the anesthesiologists on a 6-point rating scale and was maintained within deep sedation during EGD. In our study, the polyp detection rate in EGD is defined as the number of patients with polyps divided by the total number of patients examined.

#### 2.3. Statistical analysis

All analyses were performed with the SPSS statistics software, version 20 (IBM Co., Somers, NY, USA). We used the \(\chi^2\) test and the Student \(t\) test to compare the continuous and categorical variables between IVS and non-sedation EGD. Values of \(P < .05\) were considered to be statistically significant.

### 3. Results

In this retrospective observation, the total number of enrolled patients was 10,940. There were 9040 (82.6%) patients who did not receive IVS and 1900 (17.4%) patients who received IVS. As shown by the baseline characteristics in Table 1, the average age of the IVS group was significantly younger than that in the non-sedation group (50.7 years vs. 58.4 years; \(P < .001\)). Men outnumbered the women in both groups (\(P < .001\)).

The dependent clinical variables are illustrated in Table 2. The number of detected polyp was 1019 and the polyp detection rate was 9.31%. Among the patients in whom polyps were detected, 345 received IVS and 674 did not receive IVS. Compared with the non-sedation group, the IVS group had significantly higher overall polyp detection rate (18.2% vs 7.5%; \(P < .001\)); overall number (more than 3) of detected polyps (36.8% vs 30.3%; \(P = .035\)). However, detection rate of less than 2 polyps (63.2% vs 69.7%); there was no obvious significance between IVS and non-sedation EGD. Meanwhile, the detection rate of polyps < 0.5 cm was significantly higher in the IVS group than in the non-sedation group (87.0% vs 74.8%; \(P < .001\)); whereas the detection rate of polyps > 0.5 cm was higher in the non-sedation group than in the IVS group.

In this study, the location of gastric polyps detected in the IVS and non-sedation groups was most frequent in the body in 31.3% and 31.9%, respectively, followed by the fundus in 28.4% and 26.9%, respectively; the antrum in 8.1% and 10.2%, respectively; and the cardia in 7.8% and 6.2%, respectively. There was no significant difference in the polyp detection rates according to location between the IVS and non-sedation groups.

We performed multivariate logistic regression analysis of risk factors associated with the higher number of gastric polyps detected in the non-sedation EGD group in Table 3. There was no significant difference in the numbers of detected gastric polyps because of age (odd ratio, 1.007; \(P < .168\)). There was an increase in the detection rate of gastric polyps for female patients compared to male patients (odd ratio, 1.86; \(P < .001\)) and for those undergoing IVS (odd ratio, 1.50; \(P = .007\)).

| Table 1 | Characteristics of study participants with or without IVS. |
|---------|----------------------------------------------------------|
|         | with IVS | without IVS | \(P\) value |
| Age     | 50.7 ± 12.6 | 58.4 ± 16.9 | <.001 |
| Gender (Male/Female) | 1123/777 | 4615/4425 | <.001 |

IVS = intravenous sedation.
Among the patients diagnosed with gastric polyps, the pathological findings included inflammatory, hyperplastic, fundic gland polyp, adenoma, hamartoma, and gastric neuroendocrine tumor (NET). In our study, the polyp detection rate in EGD is defined as the number of patients with polyps divided by the total number of patients examined. In Table 4, hyperplastic polyps accounted for the majority of polyps detected in both the groups. There was a significantly higher polyp detection rate in the IVS group ($P<.001$). The types of pathological findings, especially in small polyp detection rate (fundic gland polyp and hyperplastic polyp), were higher in the IVS group than in the non-sedation group. In particular, the 2 cases of gastric NET that manifested as small polyps $<0.5$ cm were in the IVS group, and it showed significantly better detection in the IVS group than in the non-sedation group ($P=.002$). Polyps with adenocarcinoma found in situ in the non-sedation group were $>0.5$ cm in size in comparison with those found in the IVS group ($p=0.03$). The detection rate of epithelial hyperplasia and gastritis was also greater in the IVS group ($P=.002$). Moreover, hamartomatous polyps accounted for the majority of polyps detected in the non-sedation group ($P=.562$).

### 4. Discussion

During EGD, most patients stated unpleasant sensations of retching, which is a gag reflex triggered by the passage of EGD scope through the throat. When awake outpatients start retching, their anxiety and discomfort can make the EGD procedure difficult. The other unpleasant experiences during EGD are abdominal fullness that is caused by insufflation of the stomach and discomfort during biopsy when the EGD scope touches the gastric wall. These conditions usually lead to the patients poor cooperation, which can disturb the process of EGD. Based on the mentioned physiologic and psychological factors, sedation during EGD may be considered to relieve anxiety and discomfort.

In both the IVS and non-sedation groups in this study, there was a preponderance of men and middle-aged individuals who preferred to choose sedation EGD. Interestingly, there might be age and gender differences in the perception of procedural discomforts, such as low pain threshold, anxiety, or sensitivity of the vomiting reflex. Some studies postulated that the elderly was more prone to complete a non-sedation EGD, possibly due to the decreased sensitivity of the pharyngeal sensory function in this population. Abraham NS et al postulated that to achieve the economic impact of self-perceived level of comfort during sedation EGD, advanced age was directly related to the individual cost and risk. However, non-sedation EGD might be cost effective in some specific groups, such as those with advanced age ($>75$ years).

In Taiwan, sedation EGD is not as prevalent as in other countries. In this observational study, the less number of IVS patients than non-sedation EGD patients can be possibly explained by some reasons. One is that the cost of sedation EGD was paid by the patients and is not reimbursed by the National Health Insurance. Another 1 could be the apprehension of the patients to make the choice between IVS and non-sedation EGD. Last but not least, the adequacy of information given to the patients to make the choice between IVS and non-sedation EGD cannot be verified. It has been reported that most patients did not realize the actual level of consciousness during sedation EGD, but they were worried about the amnesia effects and delayed recovery of consciousness. Notably, it was postulated that providing IVS EGD and monitoring anesthesia care entail a great cost for routine endoscopy in healthy and low-risk patients. However, from the patients viewpoint, sedation EGD increased their satisfaction and willingness to undergo a repeat examination in the future.

In this study, the polyp detection rate during EGD was increased with IVS. Gastric polyp is the most common abnormal

### Table 2

Clinical dependent variables of study participants with or without IVS.

| Variable               | with IVS n = 345 | without IVS n = 674 | P value |
|------------------------|------------------|---------------------|---------|
| Age (y)                | 51.3 ± 11.4      | 60.6 ± 15.2         | <.001   |
| Gender (Male/Female)   | 137/208          | 222/452             | .032    |
| Number of detected polyps (%) | 218 (63.2)      | 470 (69.7)          | .035    |
| 1–2                   | 12 (36.8)        | 204 (30.3)          | .85     |
| >3                    | 300 (87.0)       | 504 (74.8)          | .001    |
| Cardia (%)             | 45 (13.0)        | 170 (25.2)          | .34     |
| Fundus (%)             | 27 (7.3)         | 42 (6.2)            | .59     |
| Body (%)               | 98 (28.4)        | 181 (26.9)          | .85     |
| Antrum (%)             | 108 (31.3)       | 215 (31.9)          | .28     |

IVS = intravenous sedation.

### Table 3

Results of multivariate logistic regression analysis of risk factors associated with the higher number of gastric polyps ($\geq 3$).

| Risk factors | Odds ratio (95% CI) | P value |
|--------------|---------------------|---------|
| Age          | 1.007               | .168    |
| Gender       |                      |         |
| Male         | 1                   |         |
| Female       | 1.86 (1.39–2.84)    | <.001   |
| IVS          |                      |         |
| not          | 1                   |         |
| yes          | 1.50 (1.12–2.01)    | .007    |

CI = confidence interval, IVS = intravenous sedation.

### Table 4

Pathology of study participants with or without IVS.

| Pathology                      | with IVS n = 1900 | without IVS n = 9040 | P value |
|--------------------------------|-------------------|----------------------|---------|
| No polyp                       | 1555              | 8366                 | <.001   |
| With polyp                     | 345               | 674                  | <.001   |
| Fundic gland polyp             | 165               | 282                  | <.001   |
| Hyperplastic polyp             | 118               | 241                  | <.001   |
| Inflammatory polyp             | 4                 | 6                    | .079    |
| Adenoma                       | 5                 | 18                   | .580    |
| Neuroendocrine tumor, grade I  | 2                 | 0                    | .002    |
| Hamartomatous polyp            | 2                 | 19                   | .562    |
| Gastrointestinal stromal tumor | 1                 | 11                   | .704    |
| Adenocarcinoma in situ         | 0                 | 14                   | .030    |
| No pathology                   | 24                | 54                   | .004    |
| Epithelial hyperplasia, gastritis and chronic inflammation | 24 | 29 | .002 |

IVS = intravenous sedation.
finding during EGD and is usually found incidentally. Gastric polyp is a protruding lesion from the gastric wall, and it is often considered as a benign lesion, with a prevalence rate of about 6% among the EGD findings in Western countries. In Eastern countries, the estimated prevalence rate was 2% to 3%, and majority were women. In this study, the detection rate of gastric polyp was 9.31% overall and was obviously higher with IVS (18.15%) than non-sedation (7.45%). In both groups, the location of the detected gastric polyps was most common in the body and fundus and did not significantly differ. In a recent study in Korea, the most frequent location of gastric polyp detection was the antrum. Carmack SW et al indicated that fundic gland polyps were more prevalent in the area of Helicobacter pylori infection. However, it is important to note that polyp location and incidence can differ among countries.

There are several different manifestations of gastric polyps or polypoid lesions. The classic pathological findings of gastric epithelial polyps include hyperplastic, inflammatory, fundic gland, and adenomatous, which account for the majority. Fundic gland polyp is the most common pathologic finding in Western countries. In Eastern countries, the pathologic types of gastric polyps vary according to region. In this study, the common pathologic types were fundic gland and hyperplastic polyps. In China, inflammatory and hyperplastic polyps are predominant in different regions, and it has been reported that hyperplastic polyps are the most common in Turkey. The other gastric polyps occasionally detected during EGD include gastric NET, xanthomas, lymphoid proliferations, or GIST presenting as mucosal protrusions.

Another remarkable observation in this study was the significantly higher detection rate for small gastric polyps, such as fundic gland polyp and hyperplastic polyp, with IVS than non-sedation (P < .001). When a gastric polyp is found during EGD, evaluation of polyp morphology and the appearance of the surrounding mucosa was the first step, followed by further interventions, such as biopsy or removal. Although small polyps, such as the hyperplastic polyp and fundic gland polyp, are considered as benign lesions, gastroenterologists may choose to advise follow-up because polypectomy is not an essential management at any time. However, there is some suggestion about 2 fragments of represented area of the polyp. For polyps larger than 10 mm or those with abnormal surrounding mucosa, the use of forceps biopsy is not enough to rule out dysplasia and carcinoma, and resection should be considered. Sedation EGD provides gastroenterologists enough time to examine polyp morphology, check the surrounding mucosa, and make decisions between forceps biopsy and endoscopic resection.

In this study, IVS during EGD increased the pathological manifestations and the detection rate of small polyps and enabled identification of 2 rare cases of gastric NET. Gastric NET is classified into 3 types and usually presents as small lesions. Clinicians should bear in mind that gastric NET can present as small polyps under EGD. Since IVS EGD increased the small polyp detection rate, gastric NET may be found effortlessly under sedative condition. Gastric NET can also present as a central ulceration, and the common locations are the fundus and body. For gastric NET type 1 and 2 that present as polyps, endoscopic resection is suggested. However, gastric NET type 3 that present as polyps any size would need partial or total gastrectomy because of the possibility of metastasis during endoscopic resection.

Hamartomatous polyp, which accounted for a significant majority in the non-sedation group in this study, is a rare finding in endoscopy and accounts for 1% of all gastric polyps. Hamartomatous polyps are possibly related to solitary or syndromic manifestation and are usually relatively large in size. Our cases of adenocarcinoma in situ usually manifested as relatively large polyps. An increased size of polyps was postulated to predispose to malignant transformation, whereas polyps smaller than 2 cm were less likely to be malignant. Clinically, large gastric polyps usually lead to problems, such as gastric outlet obstruction, abdominal pain, or upper gastrointestinal bleeding. Therefore, there is no remarkable benefit of detection on large polyp whether we performed IVS EGD or not.

Based on our observations, IVS EGD could increase the detection rate of small polyps and the uncommon pathological findings of small polyps. Increase in the patients cooperation during EGD under IVS possibly contributed to this result. On the other hand, there remains some controversial opinion that poor cooperation during EGD was correlated with IVS, which focuses on midazolam related to paradoxical reactions, and associated risks like poor oxygenation during IVS. Therefore, standardization of IVS EGD is important; notably, propofol has become the major medication for IVS EGD because of its advantages, such as rapid onset, short recovery time, amnesia effects, and anti-emetic properties. In the gastrointestinal aspect, delayed gastric emptying and much higher gastric residual volume are known adverse effects of propofol. However, a decreased gastric motility provides better visual field and operating space for the gastroenterologist performing EGD. Anesthesia monitoring is a major part during IVS EGD for preemptive airway management and prevention of airway compromise, which is common.

There were some limitations in our study. This is a retrospective study, and the patients allocation might be influenced by the doctors decision or the patients experience. In both the IVS and non-sedation groups, the clinicians judgment on patient cooperation during endoscopy was subjective, and a scale for cooperation during EGD should be considered in future studies. Moreover, endoscopic observation might have been affected by some factors, such as the presence of hiatal hernia, obesity, or previous abdominal surgery. Lastly, because of the retrospective nature of our study, further prospective or large-scale study should be considered.

For clinical application, administration of IVS could increase a patients cooperation for completion of EGD and provide physicians adequate time to analyze and manage suspicious lesions. Moreover, IVS increased the detection rates of small gastric polyps and enabled identification of unusual findings. Although IVS EGD could be a choice in clinical practice, comprehensive evaluation of a patients condition and well-trained members should be the primary considerations when performing EGD.

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