Conscious or unconscious: The impact of sedation choice on colon adenoma detection

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AIM: To determine if anesthesiologist-monitored use of propofol results in improved detection of adenomas when compared with routine conscious sedation.

METHODS: This retrospective study was conducted at two separate hospital-based endoscopy units where approximately 12,000 endoscopic procedures are performed annually, with one endoscopy unit exclusively using anesthesiologist-monitored propofol. Three thousand two hundred and fifty-two patients underwent initial screening or surveillance colonoscopies. Our primary end point was the adenoma detection rate, defined as the number of patients in whom at least one adenoma was found, associated with the type of sedation.

RESULTS: Three thousand two hundred and fifty-two outpatient colonoscopies were performed by five selected endoscopists. At least one adenoma was detected in 27.6% of patients (95% CI = 26.0-29.1) with no difference in the detection rate between the anesthesiologist-propofol and group and the gastroenterologist-midazolam/fentanyl group (28.1% vs 27.1%, P = 0.53).

CONCLUSION: The type of sedation used during colonoscopy does not affect the number of patients in whom adenomatous polyps are detected.

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Key words: Sedation; Colonoscopy; Adenoma

INTRODUCTION

Colonoscopy is recognized as the gold standard examination in screening for colon polyps. Adenomas can be precursors to colon cancer and their removal by polypectomy prevents the development of cancer in many instances. However, adenomas may be missed in up to 24% of exams according to studies employing same day, tandem colonoscopies. Among the factors shown to affect polyp detection rates are: quality of preparation, withdrawal time, image enhancements (high definition, narrow band imaging), increased visualization of the...
MATERIALS AND METHODS

Study design
This retrospective study was conducted at two separate hospital-based endoscopy units where approximately 12,000 endoscopic procedures are performed annually, with one endoscopy unit exclusively using anesthesiologist-monitored propofol. Two CRNAs staff the unit, each using the same method of administering propofol with an induction bolus followed by smaller bolus doses as required. The second unit serves both inpatients and outpatients. In this unit, gastroenterologist-controlled fentanyl and midazolam is the predominant method of sedation. Initial sedation with both medications is supplemented by small doses (0.5 to 1.0 mg midazolam or 25 mcg fentanyl) of either or both agents at the discretion of the gastroenterologist. We studied the adenoma detection rates of five experienced gastroenterologists who had each performed at least 10,000 colonoscopy exams and worked in both endoscopy units. All exams were performed using standard definition white light colonoscopes from the CF-Q160AL and CF-180AL series (Olympus America, Inc.) with standard definition high-definition flat screen monitors. The study was approved by the Norwalk Hospital Institutional Review Board.

Study sample
The study population consisted of consecutive outpatients undergoing initial screening or surveillance colonoscopy by one of the five endoscopists between January 1, 2008 and May 31, 2009. Patients were included if they met standard guidelines for screening and surveillance colonoscopy. Patients were excluded if they had a personal history of inflammatory bowel disease, a familial history of a polyposis syndrome (familial adenomatosis polyposis, hereditary non-polyposis colon cancer, juvenile polyposis, etc) or had an inadequate bowel preparation.

Outcomes
Our primary end point was the adenoma detection rate, defined as the number of patients in whom at least one adenoma was found, associated with the type of sedation.

Statistical analysis
We conducted bivariate analyses to describe the differences in patient characteristics and adenoma detection between the use of anesthesiologist-propofol and gastroenterologist-midazolam/fentanyl sedation across all 5 endoscopists. Chi-square test was used for comparing categorical variables and t-test for comparing continuous variables. The hierarchical generalized linear model (HGLM) approach was used to assess the differences in adenoma detection between the two types of sedation by modeling the log-odds of adenoma detection as a function of patient demographics and the use of propofol. To determine the influence of various patient characteristics on the adenoma detection and incidence rates, we also fitted an HGLM without adjusting for those patient characteristics. All of the HGLMs were constructed with a random endoscopist-specific effect, which accounts for a within-endoscopist correlation of the observed outcomes and separates within-endoscopist variation from between-endoscopist variation. The 95% CI was also calculated for each estimate obtained from the models and all statistical testing was 2-sided at a significance level of 0.05. All analysis was done using STATA version 10.0 (STATA Corporation, College Station, TX).

RESULTS

Patient characteristics
The study population consisted of 3252 outpatients having colonoscopy performed by one of the five selected endoscopists. Individual procedural volumes among the endoscopists ranged from 396 to 938 over the study period. The mean age was 61 years, predominately being 87.6% Caucasian (Table 1) and 53% male. The group receiving propofol was nine months older than the group receiving midazolam/fentanyl (P = 0.037). There were no statistical differences between the two sedation groups in terms of gender, ethnicity or indications for colonoscopy.
### DISCUSSION

This study shows that anesthesiologist-monitored propofol sedation was not associated with an overall significant difference in adenoma detection rate compared to gastroenterologist-monitored sedation with midazolam and fentanyl. Adjustments for patient characteristics and variation in endoscopist detection rates also failed to show an overall advantage for the detection of adenomas associated with propofol sedation.

Clear benefits of the use of propofol do exist. Anesthesiologist-monitored propofol sedation allows colonoscopy to be performed more efficiently with a more rapid onset of sedation and shorter patient recovery times. This type of sedation also frees the endoscopist from making decisions regarding the level of sedation and patient monitoring, allowing full concentration on the endoscopic task at hand. A 5-year review of the Clinical Outcomes Research Initiative database showed that more large (> 9 mm) polyps were detected during average risk screening colonoscopy exams using deep sedation with propofol than with moderate conscious sedation [10]. In this study, 20% more polyps were detected and multivariate analysis found no factors other than propofol sedation to account for the difference. In contrast, our study examined the detection of potentially pre-cancerous adenomatous polyps of any size, and did not find a benefit to the use of propofol. Both studies were retrospective in nature.

Polyp detection rates vary with the time spent examining the colonic mucosa during withdrawal of the instrument, the quality of the preparation and optical enhancements such as high definition scopes and monitors and narrow band imaging. In our study, procedural technique and daily patient volume were the same for each endoscopist in both the anesthesiologist-propofol and gastroenterologist - midazolam/fentanyl endoscopy units. All preparations were graded good to excellent.

### Adenoma detection rates

Overall, at least one adenoma was detected in 27.6% of patients (95% CI: 26.0-29.1) with no difference noted in the detection rate between the anesthesiologist-propofol group and the gastroenterologist-midazolam/fentanyl group (28.1% vs 27.1%, \( P = 0.53 \)). Although there was substantial variation in overall adenoma detection rates among the individual endoscopists (ranging from 35.1% to 12.9%), the type of sedation used was not associated with differences in rates of adenoma detection (Table 2).

Because patient assignment to either the propofol or midazolam/fentanyl sedation group was not randomized, HGILM was used to determine whether any of the patient characteristics (age group, ethnicity, gender or indication for colonoscopy) contributed to the observed adenoma detection rates. Using midazolam/fentanyl sedation as the reference standard, the odds ratio for the detection of adenomas does not differ when propofol is used and the results are adjusted for patient and physician characteristics (Table 3). Using the model, no difference in adenoma detection rates was identified when each of the five patient age groups were examined individually.

### Table 1 Patient characteristics n (%)

| Characteristic | Propofol \n\( n = 1456 \) | Midazolam/Fentanyl \n\( n = 1796 \) | \( P \) value |
|---------------|----------------|----------------|-----------|
| Mean age      | 61.0 10.3      | 60.2 9.9       | 0.037     |
| Female        | 669 45.9       | 860 47.8       | 0.285     |
| White         | 1291 88.7      | 1556 86.7      | 0.08      |
| Surveillance  | 398 27.3       | 525 29.3       | 0.227     |

### Table 2 Physician adenoma detection rates

| Physician | Propofol | Midazolam/Fentanyl | \( P \) value | Total cases |
|-----------|----------|---------------------|--------------|-------------|
|           | Adenoma \((\geq 1)\) (%) | Adenoma \((>1)\) (%) |            |             |
| A         | 506 31.3 | 160 31.6             | 0.903        | 938         |
| B         | 442 35.5 | 154 34.8             | 0.856        | 769         |
| C         | 382 29.3 | 382 29.3             | 0.255        | 769         |
| D         | 222 13.9 | 222 13.9             | 0.459        | 489         |
| E         | 239 24.8 | 47 19.7              | 0.222        | 396         |
| Overall   | 1796 28.1 | 1796 27.1             | 0.547        | 3252        |

### Table 3 Hierarchical generalized linear model predicting adenoma detection

| Model                                | Odds ratio | Adenoma detection 95% CI | \( P \) value |
|--------------------------------------|------------|--------------------------|--------------|
| Unadjusted for patient characteristics and physician | 1.00       | 0.93-1.28               | 0.267        |
| Propofol                             | 1.09       | 0.93-1.28               | 0.267        |
| Adjusted for patient characteristics and physician | 1.00       | 0.91-1.26               | 0.402        |
| Versed (reference)                   | 1.00       | 0.91-1.26               | 0.402        |
| Versed (reference)                   | 1.00       | 0.91-1.26               | 0.402        |
were performed with a mix of Olympus CF-Q160AL and CF-180AL series instruments, the latter with narrow band imaging capability. High definition instruments were not in use in our units at the time of the study.

Our arrangement with 2 endoscopy suites, one providing exclusively anesthesiologist-monitored propofol and the other providing predominantly gastroenterologist-controlled fentanyl and midazolam, provided a convenient, albeit non-randomized method to compare whether type of sedation was associated with adenoma detection rates. The fact that each physician worked in the propofol unit on the same day each week introduced a potential confounding variable, however, we are not aware of any literature correlating adenoma detection rates with the day of the week the procedure is performed.

While retrospective, this study represents the ‘real world’ practice of colonoscopy with experienced clinicians performing both screening and surveillance exams on patients who are receiving either anesthesiologist or operator controlled sedation. Our data show that the detection rate of adenomatous polyps of all sizes is not increased by the use of anesthesiologist monitored propofol sedation compared to gastroenterologist monitored sedation with midazolam/fentanyl. While the use of propofol based anesthesia is certainly associated with increased patient satisfaction, the detection rate of adenomatous colon polyps is not enhanced.

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This paper is well written and covers important topics and findings.

**COMMENTS**

**Background**

Colonoscopy is the gold standard examination in screening for colon polyps. Adenomas can be precursors to colon cancer and their removal by polypectomy prevents the development of cancer in many instances. Yet it has been shown that adenomas may be missed up to 24% of the time.

**Research frontiers**

Many factors have been shown to affect polyp detection rates including: quality of preparation, withdrawal time, image enhancement, polyp size, increased visualization with Third Eye Retroscope and time of day. However, few studies have shown any adenoma detection rate differences in the type of sedation used.

**Innovations and breakthroughs**

This is one of the first studies of its kind to investigate whether or not anesthesiologist monitored use of propofol would affect the adenoma detection rate when compared to gastroenterologist-monitored use of fentanyl and midazolam. The data suggest that anesthesia monitored propofol sedation was not associated with an overall significant difference in adenoma detection rate compared to gastroenterologist monitored sedation with midazolam and fentanyl.

**Applications**

The data suggest that the detection rate of adenomatous polyps of all sizes is not increased by the use of anesthesiologist monitored propofol sedation compared to gastroenterologist monitored sedation with midazolam/fentanyl. While the use of propofol based anesthesia is certainly associated with increased patient satisfaction, the detection rate of adenomatous colon polyps is not enhanced. This study could have future financial implications given the cost of anesthesiologist monitored propofol sedation.

**Terminology**

Propofol is a short-acting, intravenously administered hypnotic agent. Its uses include the induction and maintenance of general anesthesia, sedation for mechanically ventilated adults, and procedural sedation. Midazolam is a short-acting drug in the benzodiazepine class that is used for treatment of acute seizures, moderate to severe insomnia, and for inducing sedation and amnesia before medical procedures. Fentanyl is a strong agonist on the μ-opioid receptors and is commonly used before procedures as an anesthetic in combination with a benzodiazepine.

**Peer review**

This paper is well written and covers important topics and findings.