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# Sedation Associated with a More Complete Colonoscopy

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**Background.** This study examined the effect of sedation on the rate of complete colonoscopic examinations by a family physician performing colonoscopy at an urban family practice residency. The outcomes of biopsies and polypectomies performed during the period of the study were also evaluated.

**Methods.** Data were prospectively collected on 164 consecutive colonoscopies. Seventy-three percent (124/164) of the examinations were training experiences supervised by the first author. The outcomes of examinations of 126 sedated patients were compared with those of 38 nonsedated patients. Patients were not randomly selected.

**Results.** Examinations of 126 sedated patients were carried out with an 85% reach-the-cecum rate compared with a 31% reach-the-cecum rate for 38 nonsedated patients ( $P < .05$ ). A higher percentage of examina-

tions done without sedation (16%) were terminated because of pain than were terminated in sedated patients (5%) ( $P < .05$ ). An electrolyte purge solution was found to be the most effective colonoscopy preparation; only 7% (7/100) of examinations on patients prepared by this method were terminated because of inadequate bowel preparation. Adenomas were found in 11% (14/126) of sedated patients and in 8% (3/38) of nonsedated patients. Cancer was detected in 4 sedated patients.

**Conclusions.** These findings suggest that sedation in colonoscopy is associated with a higher percentage of complete examinations. Also, patients prepared with an electrolyte purge solution tend to have fewer examinations terminated because of inadequate preparation.

**Key words.** Colonoscopy; primary care; colorectal neoplasms; conscious sedation. (*J Fam Pract* 1993; 36:394-400)

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During the decade of 1979 to 1989, family physicians published data supporting the use of 35-cm flexible sigmoidoscopy and 65-cm short colonoscopy.<sup>1-3</sup> Flexible endoscopy has led to improved diagnostic yields, better patient acceptance, and improved teaching.<sup>4</sup> By 1986, preliminary data from using longer scopes emerged.<sup>5</sup> One author suggested that flexible sigmoidoscopy skills would provide the gateway to the "despecialization of endoscopy."<sup>6</sup>

This despecialization would be manifested by the acquisition of colonoscopy and upper gastrointestinal

endoscopy skills by family physicians.<sup>7</sup> By 1989, both of these skills had been described in papers presented at the American Academy of Family Physicians Scientific Assembly, and studies suggesting the effectiveness of colonoscopy by family physicians were subsequently published.<sup>8,9</sup>

When the 60-cm scope was unavailable or out for repair, it had been the custom of one author (W.M.R.) to use the longer colonoscope. Similar to the experience of Dervin and others, in some of these nonsedated procedures the physician was able to reach the cecum with the scope.<sup>5,10</sup> This led to speculation that a complete intestinal examination to the cecum might be accomplished in the office setting without sedation. A number of other colonoscopists have questioned the necessity of sedation in every colonoscopy examination.<sup>9-11</sup> Herman concluded that in most cases sedation is unnecessary, and

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that sedation should not be used to abet poor technique.<sup>10</sup> Others believe that, even with a proper technique, a greater percentage of complete examinations, those that reach the cecum or the ileocolonic anastomosis, can be achieved with the use of sedation.<sup>11</sup>

The colonoscope has proved to be safe as well as beneficial to patients. Full-length colonoscopy is now a common procedure that is performed by physicians in a variety of specialties.<sup>12-16</sup> This report is a prospective study examining the hypothesis that sedation is associated with a greater frequency of colonoscopic examinations to the cecum. It also extends the small amount of published literature describing the outcomes of colonoscopy by family physicians.

## Methods

Between August 1989 and April 1992, 164 consecutive colonoscopies were performed on 162 patients at a family practice residency training site in an urban area. These 164 procedures were performed or supervised by the first author, who is a board-certified, residency-trained family physician who received endoscopy training after completion of residency. One hundred twenty-four of these procedures were training experiences performed or assisted by family practice residents or faculty.

During the study period, the practice from which these patients were drawn saw an average of 50 patients per day, of whom slightly more than 80% were adults. The physician (one of the authors) performed 5 to 6 colonoscopies per month during this study period.

Of the 164 procedures, 126 were performed on patients under sedation. The sedatives used were meperidine and diazepam. Thirty-eight procedures were performed without sedation. Patients were not randomly selected. Selection for the nonsedated group occurred by preference of the primary care physician, who requested flexible sigmoidoscopy and possible air-contrast barium enema to follow. One instrument was used on all patients, and an attempt to reach the cecum was made in all cases. The insertion depth and reason for stopping were noted.

Patient preparation for colonoscopy included laxatives and enemas or colonic lavage (electrolyte purge solution). Early in the series of colonoscopies, four bisacodyl 5-mg tablets were prescribed, to be taken at 8:00 PM the evening before the examination. Patients were instructed to drink clear liquids after 6:00 PM and in the morning. A sodium phosphate enema was administered at home and an additional enema was administered in the office if the patient could not confirm clear results from the first enema. Later in the study, the authors preferen-

tially started using a balanced electrolyte purge solution such as Golytely (Braintree Laboratories, Braintree, Mass) or Colyte (Reed and Carnick, Piscataway, NJ). These preparations were selected in a nonrandom manner by the primary care physician or nursing staff.

In the patients to be sedated, intravenous administration was begun just before the examination. A test dose of 1 mg diazepam was administered 90 seconds after a 25-mg test dose of meperidine. If no adverse effects were noted from the test dose, an additional 50 mg of meperidine was administered. After 90 seconds, 2-mg increments of diazepam were administered until conscious sedation was noted by the presence of slurred speech, drooping eyelids, or light sleep.

All examinations in this study were performed using a Welch Allyn 150-cm colonoscope (Welch Allyn, Skaneateles Falls, NY). All examinations were performed in a fully equipped endoscopy suite including advanced cardiac life support resuscitation equipment and pulse oximetry.

Data were collected in a prospective manner. A colonoscopy data sheet was filled out by the physician at the time of the colonoscopic examination. Data included date of examination, patient age and sex, history of abdominal surgery, indication for procedure, depth of scope insertion, and whether the transverse colon or cecum was visualized. Ascertainment of reaching the cecum was determined by anatomical landmarks, ballottement above the right inguinal canal, or transillumination. Upon withdrawal of the scope into the rectal canal, the scope tip was retroflexed such that an internal view of the dentate line was obtained. This retroflexion is also known as the turn-around maneuver or the "J maneuver." Those examinations in which endoscopic biopsy was performed without electrocautery were noted as being "exams with biopsy only."

Data also included reasons for stopping, physician's findings, scope depth at which polyps were found, whether a biopsy or polypectomy was performed, whether the turn-around maneuver was performed, whether a barium enema was ordered, and time required for examination. Pathology reports for any biopsies or polypectomies were also collected.

Means of continuous data were compared using a two-tailed Student's *t* test. Categorical data were compared by chi-square analysis of 2 × 2 contingency tables.

## Results

Clinical and procedural data are shown in Table 1. Data were similar between the two groups. The average examination time was less for the nonsedated patients, al-

Table 1. Clinical and Procedural Data for 164 Patients Who Underwent Colonoscopy

	Sedated (n = 126)	Nonsedated (n = 38)	P Value
Age, y			
Average	55	58	NS
Range	23-88	25-92	
Sex, %			
Male	44	39	NS
Female	56	61	
Procedure time,* min			
Average	32	27	<.07
Range	10-120	2-60	
Examinations, %			
With biopsy only	19	29	NS
With electrocautery	11	0	<.05
Previous abdominal surgery, †%	51	53	NS
Turn-around maneuver performed, %	93	89	NS

\*Time data missing for 2 procedures (1 sedated, 1 nonsedated).

†Abdominal surgery data missing for 7 procedures (4 sedated, 3 nonsedated).

though the difference was not statistically significant ( $P < .07$ ). No polypectomies were performed on nonsedated patients. When polypectomy cases were eliminated, the average examination time in sedated patients (29 minutes) was similar to that in nonsedated patients (27 minutes).

Colonoscopy indications for the sedated and nonsedated groups compared in this study are shown in the figure. For most of the colonoscopic indications, there was no significant difference between the sedated and nonsedated groups. A higher percentage of the patients

with "weight loss" were examined under sedation than those examined unsedated. On the other hand, examinations without sedation were given to a higher percentage of patients with the indications "change in bowel habits" or "other" than the percentage of patients examined under sedation ( $P < .05$ ).

Three sedated and six nonsedated patients had "other" listed as the indication. Four patients examined without sedation had "other" listed as the only indication: one patient had an abdominal mass, one had a history of colitis, and two procedures were done solely for screening purposes. One sedated patient had "other" listed as the only indication; this patient had an elevated carcinoembryonic antigen. In the four remaining procedures with "other" tabulated as the indication, the patients also had rectal bleeding, change in bowel habits, or abdominal pain. Three of these patients had an abdominal mass and one had a history of cervical cancer.

Electrolyte purge solution was the most effective colonic preparation used in this study. Examinations were terminated because of inadequate preparation in only 7% (7/100) of patients prepared with the purge solution, whereas 30% (19/64) of patients prepared with laxatives or sodium phosphate enemas or both had their examinations stopped because of poor preparation. This difference was significant ( $P < .05$ ). The type of preparation (electrolyte purge solution or laxatives and sodium phosphate enema) used differed significantly between the sedated and nonsedated groups. Seventy-two percent (90/126) of sedated patients were prepared with the purge solution, whereas only 24% (9/38) of the nonsedated patients were given that preparation ( $P < .05$ ).

The average doses of sedatives given to the sedated

Indications for colonoscopy. The sum of the number of examinations in each indication category is greater than 164 because many patients had more than one indication. Eighty-seven patients (68 sedated and 19 nonsedated) had only one indication, and 60 patients (48 sedated and 12 nonsedated) had two indications. The remaining patients had three or more indications.

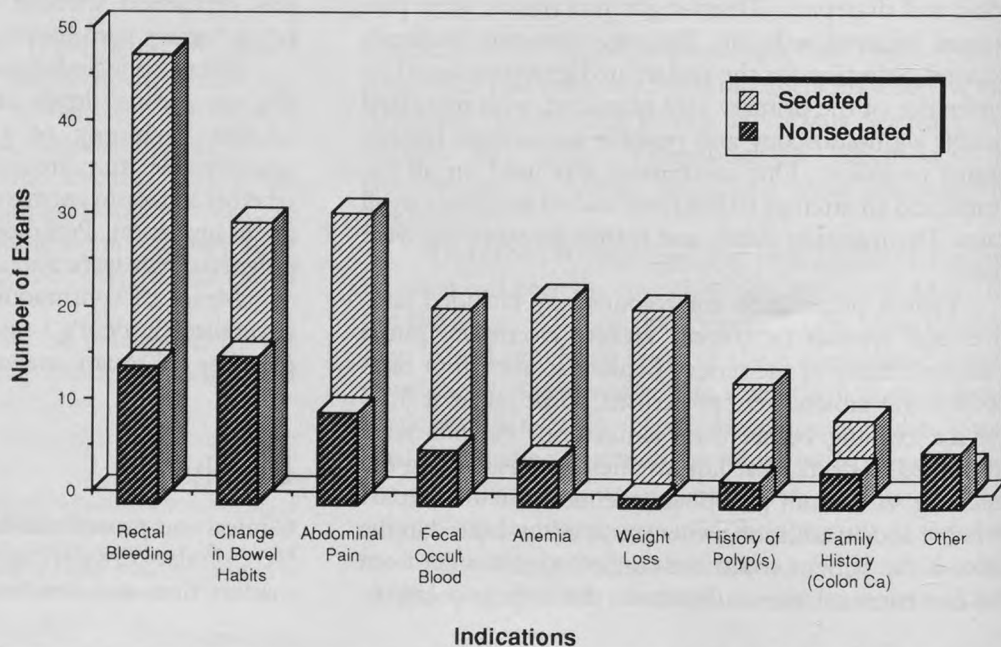


Table 2. Effect of Sedation on Anatomical and Scope Insertion Depths

	Sedated (n = 109)	Nonsedated (n = 26)	P Value
Procedures in which the transverse colon was reached, %	92	62	<.05
Procedures in which cecum was reached, %	85	31	<.05
Average insertion depth (cm)	134	81	<.05

NOTE: This table does not include data for 30 procedures terminated because of inadequate preparation (14 sedated, 13 nonsedated patients) or obstruction (3 sedated patients).

patients were 92 mg meperidine and 5.9 mg diazepam with a range of 25 to 150 mg and 1.0 to 15.0 mg, respectively. Dosage data were not available for 21 of the 126 sedated patients.

As shown in Table 2, examinations of sedated patients had significantly higher anatomical insertion depth rates (percent of examinations in which the transverse colon or cecum was reached) and linear scope insertion depth than those of the nonsedated patients. Examinations of sedated patients with prior abdominal surgery had significantly lower insertion depths than those of patients without prior abdominal surgery ( $P < .05$ ). This difference was not present in examinations of the nonsedated patients. Prior abdominal surgery status was, therefore, not factored into Table 2 since it would have led to an even greater difference between the insertion depths of the examinations of the sedated and nonsedated patients. Data for 29 procedures that were terminated because of inadequate preparation (26) or obstruction (3) were omitted from Table 2 because these examinations were not a valid measure of the colonoscopist's skill.

Table 3 lists the reasons for stopping examinations in the sedated and nonsedated groups. There was a significant difference between the two groups for all reasons for stopping listed in Table 3 except obstruction.

Table 3. Reasons for Stopping Colonoscopy Examination

Reason for Stopping	Sedated (n = 126) No. (%)	Nonsedated (n = 38) No. (%)	P Value
Cecum reached	93 (74)	8 (21)	<.05
Inadequate preparation	14 (11)	12 (32)	<.05
Unable to traverse lumen	10 (8)	12 (32)	<.05
Pain	6 (5)	6 (16)	<.05
Obstruction	3 (2)	0	NS

Note that whereas examinations in 16% of nonsedated patients were terminated because of pain, examinations in less than 5% of sedated patients were terminated for this reason ( $P < .05$ ).

The colonoscopic findings of the examining physician did not differ significantly between the sedated and nonsedated groups. Approximately 70% (117/164) of all examinations were found to be normal; this percentage includes patients in whom hemorrhoids and diverticula were found. Polyps were detected in 21% (34/164) of patients and mucosal abnormalities or masses or lesions were found in 6% (10/164).

Twenty-four biopsies and 14 polypectomies were performed in patients under sedation, and 11 biopsies were performed in nonsedated patients. Four cancers, 14 adenomatous polyps, 6 hyperplastic polyps, and 1 case of ulcerative colitis were found in sedated patients. Of nonsedated patients, 3 had hyperplastic polyps and 3 had adenomatous polyps. The percentages of documented abnormalities did not differ significantly between the sedated and nonsedated groups. Forty-eight percent (12/25) and 33% (2/6) of the documented abnormalities were located proximal to the sigmoid-descending colon junction in the sedated and nonsedated patients, respectively. This difference was not significant.

The highest percentage of abnormalities was found in patients with a history of polyps or with positive fecal occult blood tests. Thirty-three percent (5/15) of patients with a history of polyps had abnormalities; 4 had adenomas, and 1 had cancer. Twenty-two percent (6/27) of patients presenting with positive fecal occult blood had adenomatous polyps. Abnormalities were detected in 17% (8/47) of patients presenting with rectal bleeding; 1 patient had ulcerative colitis, 5 had adenomas, and 2 had cancer. Note that the percentages of patients with indications mentioned above were similar for the sedated and nonsedated groups.

In the case of two patients, both underwent two colonoscopies under sedation. Cancer was detected in both of these patients during their first examinations. Their second colonoscopies were follow-up examinations performed 6 months after resection surgery. Tissue for biopsy was taken in each patient's follow-up examination; an adenoma was found in one and mild inflammation in the other. In this study, the two repeat examinations were treated as independent events.

No complications occurred during this study. One patient complained of left lower quadrant pain 2 days after a polypectomy and was admitted to the hospital family practice teaching service. Surgical and radiologic consultations were inconclusive, and no invasive procedures were necessary. The patient was treated with antibiotics, and his symptoms were relieved the following

day. On the third day, he was discharged in good condition.

## Discussion

One hundred sixty-four colonoscopies, which included 35 biopsies and 14 polypectomies, were carried out by a family physician without major complication. Perry et al<sup>17</sup> have also shown that, for low-risk patients, colonoscopy and polypectomy can be performed safely in an office setting.

The results of these 164 colonoscopies demonstrate that the use of sedation for colonoscopy leads to a greater percentage of complete examinations. Examinations of sedated groups had significantly higher anatomical and linear scope insertion depths than nonsedated groups ( $P < .05$ ). Note that only 31% of examinations of nonsedated patients reached the cecum; 85% of examinations of sedated patients reached the cecum.

In 16% of nonsedated patients, examinations were terminated because of pain, whereas examinations in only 5% of sedated patients were terminated for that reason ( $P < .05$ ). In the report by Rex et al<sup>18</sup> of 500 nonsedated patients who received colonoscopies, 56% of the examinations were terminated because of pain. In a study of 59 nonsedated patients undergoing colonoscopies, Lo et al<sup>19</sup> showed that 58% of examinations that would have been terminated because of pain were continued to the cecum with the addition of sedation. Achieving a greater percentage of complete examinations is an obvious benefit of sedation. Furthermore, some researchers have claimed that patients would be less likely to undergo further colonoscopic examinations after a procedure given without sedation than one in which sedation was used.<sup>11</sup>

Examinations in 11% of sedated patients and 32% of nonsedated patients were terminated because of inadequate preparation ( $P < .05$ ). A balanced electrolyte purge solution (Golytely, Braintree Laboratories, Braintree, Mass, or Colyte, Reed and Carnick, Piscataway, NJ) was the most common preparation used. It was also the most reliable preparation used; less than 7% of examinations on patients prepared with the balanced electrolyte purge solution were terminated because of inadequate preparation. The most likely cause of the nonsedated patients' higher rate of inadequate preparation is that only 25% of their examinations were prepared with the purge solution as compared with 73% of examinations of sedated patients ( $P < .05$ ).

Abnormalities were found in 20% (25/126) of sedated and 16% (3/38) of nonsedated patients. These included cancer, which was detected in 3% (4/126) of

sedated patients' examinations. Other colonoscopy studies have found polyp rates (hyperplastic plus adenoma) of 12% to 41% and cancer rates of less than 2%.<sup>18-22</sup> Of the abnormalities found in this study, 48% (12/25) in sedated patients' examinations and 33% (2/6) in nonsedated patients' examinations were located proximal to the sigmoid-descending colon junction. Some studies have found that approximately two thirds of abnormalities were located proximal to the sigmoid-descending colon junction.<sup>20-21</sup> Other studies have also examined the distribution of abnormalities and found 34% to 46% located proximal to the splenic flexure.<sup>22-23</sup>

This study attempts to remove confounding findings such as hemorrhoids and diverticula. If these were included, the quantity of abnormalities would be higher. Reporting bias is possible since the principal investigator was also responsible for creating the medical record. However, all biopsy and polypectomy reports were obtained through an independent pathology laboratory. This was accepted as the "gold standard," and overreporting of disease is unlikely.

Two nonsedated colonoscopies in this study were performed solely for screening purposes. Current screening for colorectal cancer involves fecal occult blood tests and flexible sigmoidoscopy. Screening is not currently considered a proper indication for full-length colonoscopy. Nevertheless, many physicians are now calling for colonoscopy to be the primary mode of colorectal cancer screening, especially in patients over the age of 60 years.<sup>20-25</sup> In a flexible sigmoidoscopy examination, only a fraction of the large colon is visualized; therefore, a substantial percentage of adenomas located in the proximal colon are missed.<sup>20-23</sup>

The alternative to complete visualization of the colon by colonoscopy is air-contrast barium enema. Colonoscopy has been shown to be more acceptable to patients, however, and it is more sensitive than barium enema examination.<sup>14,26</sup> On the other hand, some believe that the higher acceptance rates for colonoscopy have been biased because each patient receives intravenous sedation. It has been pointed out that this is an additional risk factor that is not present with barium enema.<sup>27</sup> Warden et al<sup>28</sup> have defended the strategy of flexible sigmoidoscopy with barium enema to follow. Some have suggested that the air-contrast barium enema is the most cost-effective approach.<sup>29-30</sup> Nelson and Pemberton<sup>31</sup> have reported a balanced view by stating that "the accuracy and availability of these procedures in a given medical community will vary, and choices should be made accordingly." Varma and Burton<sup>32</sup> have also discussed the complementary nature of lower endoscopy and radiography.

A previous study by Dervin<sup>5</sup> using a 105-cm

colonoscope in nonsedated patients in a family practice setting noted an ability to insert the colonoscope to its full length in 14 of 49 examinations. This percentage (29%) was very similar to the percentage of nonsedated patients in whom the cecum was reached in our series reported in this paper. Dervin also reported problems with inadequate bowel preparation. In a recent study of 500 flexible sigmoidoscopies performed with a 168-cm colonoscope in nonsedated patients, the investigators concluded that minimal benefit was gained using the long scope. "Substantial improvements in polyp yield are likely to be achieved only by full colon cleansing [electrolyte purge] and performance of colonoscopy with appropriate sedation."<sup>18</sup>

In this study, the balanced electrolyte purge appears to be the bowel preparation of choice. Before this time, other preparations were recommended because clinicians believed their effectiveness was equal to that of the less palatable electrolyte purge solution. A reportedly more palatable version (Nulytely, Braintree Laboratories, Braintree, Mass) is now available.

This study may not be generalizable to all family physicians since it reports on the results of only one family physician at one site. The ability to detect significant lesions without causing additional morbidity, however, is reassuring. The cases in our study may represent colonoscopy in a more difficult environment, as teaching is conducted during the examination and learners are not usually as accomplished in the technique.

The patients were not randomized and this could have led to selection bias. Note that sedation was more frequently used in examinations of patients with weight loss. Generally, examinations without sedation may have been reserved for those patients with less dramatic symptoms. Only two of these examinations were done for screening purposes, and all examinations started with the objective of examining the entire colon. Incomplete examinations were followed by air-contrast barium enema examinations, which in this study did not reveal additional numbers of proximal lesions.

This paper extends the observations of family physicians providing colonoscopy services. It suggests that the procedure can be safe and effective in the detection of significant colorectal disease. The study suggests that the use of sedation and an electrolyte purge solution assists in maximizing the ability to reach the cecum. Prior abdominal surgery was found to make the examinations more difficult. In this study, a "first-generation" videosigmoidoscope was used, which has now been discontinued. Others have reported that reach-the-cecum rates are higher with new "second-generation" equipment (J. Hocutt, MD, personal communication, May 1990).

Another weakness of this report is the relatively high

percentage of terminations because of inadequate preparation. A previous study on the barium enema found a cancellation rate of 14% due to inadequate preparation.<sup>33</sup> Up to 24% of patients were sent home to complete an additional day of bowel preparation. The higher rate of poor preparation may have falsely lowered the reach-the-cecum rate in the nonsedated group.

Among 33 incomplete examinations of sedated patients, the investigators were able to locate barium enema results on 20. This highlights the difficulty in providing good follow-up when multiple procedures are necessary to complete the entire examination. Undoubtedly, good medicine can be confounded by numerous psychosocial issues such as patient understanding, fear, anxiety, lack of funds, and distance. When a potential case of colorectal cancer exists, patients might reasonably benefit from the most thorough examination available to them with the greatest ease. The family physician is in a good position to offer this high quality care at a reasonable cost via the relatively easy-to-access family practice office.<sup>34</sup>

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