Colonoscopy Performed by a Family Physician

A Case Series of 751 Procedures

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BACKGROUND. Colonoscopy, including biopsy and polypectomy, is a procedure not commonly performed by primary care physicians. The purpose of this research was to present a large case series of colonoscopic procedures performed by a family physician in a rural practice.

METHODS. A chart review of every colonoscopy procedure performed by a family physician over a 7-year period determined the demographic characteristics, indications, findings, and complications for each procedure.

RESULTS. A total of 751 colonoscopies were performed on 555 patients (347 women and 208 men), with a mean age of 53.8 years. In 91.5% of procedures, the cecum was intubated. The most common indications for colonoscopy were bleeding (49.9%), polyp follow-up (20.9%), abdominal pain (11.7%), diarrhea (11.6%), and abnormal findings on flexible sigmoidoscopy (8.4%).

Three hundred sixteen benign polyps were discovered and removed by either biopsy or polypectomy. There were 184 adenomatous colorectal polyps found in 134 (17.8%) colonoscopies. Of these 184 adenomatous polyps, 106 (58%) were potentially within reach of the flexible sigmoidoscope. Only three adenocarcinomas were discovered during the entire study period. There was only one major procedural complication: a patient experienced blood oozing from a polypectomy stump; cautery stopped the bleeding, and the patient was hospitalized overnight, with no further intervention or transfusion required. There were five other self-limited complications, including adverse reactions to sedation and infiltration at the intravenous site.

CONCLUSIONS. Colonoscopy with polypectomy that was safely and competently performed in a solo rural practice adds to the evidence that experienced family physicians can provide this important service to their community.

KEY WORDS. Colonoscopy; adenomatous polyps; colorectal neoplasms; physicians, family. *(J Fam Pract 1997; 44:473-480)*

As medicine progresses, technical procedures such as gastrointestinal endoscopy become despecialized.[1] For example, flexible sigmoidoscopy is now performed by 29% to 57% of US family physicians and 42% of general internists.[2-4] Colonoscopy requires more technical expertise than flexible sigmoidoscopy, and primary care physicians may find it difficult to acquire these skills once in practice.[5] In recent surveys, 2% to 3% of US family physicians and general internists performed colonoscopy, in office or hospital settings.[3,4,6] Most of these physicians mastered this procedure after formal residency training.[7]

We report a case series of 751 colonoscopic procedures by a family physician in rural south Georgia. He acquired all his endoscopic training, experience, and competence while in solo practice.

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METHODS

This study examined every colonoscopy performed by the first author (R.P.J.P.) from November 1988

through December 1995. All procedures were performed in the endoscopy suites of two small hospitals in southern Georgia. The general policy followed was to completely remove colorectal polyps, regardless of size.[8,9] Bowel preparation was accomplished with 4 to 6 L of oral polyethylene glycol (Golytely). Unstable patients or those with brisk gastrointestinal bleeding were referred to other physicians. An endoscopy log recorded demographic information; additional clinical information was recorded in the private office records. The choice and dosage of intravenous sedation were recorded. The adequacy of the bowel preparation was subjectively rated as excellent, fair, or poor.

The indication(s) for the colonoscopy were noted. All varieties of lower gastrointestinal (GI) bleeding, from asymptomatic positive stool hemoccult to gross rectal bleeding, were categorized as bleeding. Depth of insertion and site of any lesions were recorded using the following locations: rectum, sigmoid colon, descending colon, splenic flexure, transverse colon, hepatic flexure, ascending colon, cecum, and ileum. Visualization of the cecum beyond the ileocecal valve was the primary determinant of the colonoscope having reached the cecum. Supporting evidence of cecal intubation included identification of landmarks on the way to the cecum and identification of the confluence of the taenia coli or appendiceal orifice, as well as entry into the ileum, when performed. Cecal intubation rate was calculated as the percentage of procedures in which the colonoscope tip reached the cecum or ileum.

For every polyp noted, we recorded the estimated size, location, clinical impression, whether a biopsy or polypectomy was performed, and the pathologic diagnosis. Other diagnostic impressions (besides polyps) were also documented. Finally, all complications were recorded, using the 5-category nomenclature recommended by Fleischer and co-workers.[10]

The first author currently performs all of his GI endoscopic procedures in a 180-bed hospital accredited by the Joint Commission on Accreditation of Healthcare Organizations, in a fully equipped endoscopy center that follows current guidelines for quality assurance. For all patients, a preoperative history is taken, a physical examination performed, and an extensive informed consent obtained. All patients are monitored with intermittent blood pressure auscultation, continuous electrocardiography and pulse oximetry, and intravenous access.

All data were entered retrospectively by a single research assistant over an 8-week period. The assistant obtained data from the endoscopy logbook and from individual patient records. Data were entered directly into a database program, SPSS/PC (SPSS Inc, Chicago, Ill). Differences in proportions were tested by the chi-square critical ratio test.[11]

Education, Training, and Credentialling

The first author completed medical school and family practice residency in Canada, with no training in gastrointestinal endoscopy. After several years of private practice, he learned flexible sigmoidoscopy and did over 700 of these procedures in his office. He attended a didactic, model-based colonoscopy course, and then was precepted for 80 colonoscopic procedures by general surgeons and family physicians for a 2-year period. He received full colonoscopic privileges, including polypectomy (as well as esophagogastroduodenoscopy), in a small rural hospital. He then applied for privileges at the 180-bed community hospital in his own town; this credentialling was more difficult, but he obtained full colonoscopic privileges, with polypectomy.

RESULTS

During the 7-year period, 555 patients (347 women and 208 men) underwent 751 colonoscopic procedures. The frequency of colonoscopies performed ranged from 5 to 7 per month during the first year, increasing to a stable rate of 9 to 11 per month for the last 3 years.

The age distribution of the patients at the time when their first colonoscopy was performed by this family physician is displayed in Figure 1. The mean age was 53.8 ± 18.1 years, with a range from 10 to 95 years. A total of 430 patients had one colonoscopy; the remaining 125 patients underwent two or more colonoscopies during the study period: 74 had two procedures, 38 had three, 8 had four, 3 had five, and 2 had six.

All patients were given intravenous sedation. Meperidine was used in 656 of 713 cases (92.0%), at a mean dose of 42.9 mg (range 12.5 to 100 mg). Midazolam was used in 731 of 743 cases (98.4%), at a mean dose of 4.3 mg (range 0.5 to 14 mg).

The mean doses of sedative medications declined over the course of the study period, particularly for

meperidine. The mean dose of meperidine fell from 60.7 mg in the first decile of patients to 27.1 mg in the final decile, a 55.4% decline. The mean dose of midazolam fell from 5.2 mg in the first decile of patients to 4.0 mg in the final decile, a 23.1% decline. This was in keeping with a general trend of declining sedative doses used by other local endoscopists.

The adequacy of bowel preparation was excellent in 575 (79.2%), fair in 131 (18.0%), and poor in 20 (2.8%). The adequacy of bowel preparation appeared to improve throughout the study period, an improvement that coincided with a change in preparation protocol: lemon flavoring was added to the bowel preparation solution, and an additional 2 L was taken early on the day of the procedure.

There were 886 indications for the 751 colonoscopies (Table 1). Gastrointestinal bleeding was the most common indication (49.9%), followed by polyp follow-up (20.9%), abdominal pain (11.7%), diarrhea (11.6%), and abnormal findings on flexible sigmoidoscopy (8.4%). In 638 procedures, there was a single indication; in 94 procedures, there were two indications; in 16, three indications, and in 3, there were four indications.

Cecal intubation was achieved in 91.5% of the 751 procedures. This rate was constant throughout the study period, with no discernible "training effect." The cecal intubation rate was strikingly associated with the adequacy of bowel preparation: for procedures with an excellent preparation, the cecal intubation rate was 544 of 575 (94.6%), compared with 115 of 131 (87.8%) with a fair preparation, and 9 of 20 (45.0%) with a poor preparation ($P<.0001$ for the overall comparison). The cecal intubation rate was higher in men (96.9%) than in women (88.0%, $P<.0001$ for the comparison). Age had no effect on the cecal intubation rate.

Of the 64 patients who had an incomplete study,

FIGURE 1

Age distribution of 555 patients who underwent 751 colonoscopies performed by a family physician. For patients with more than one procedure, the age at first procedure is indicated.

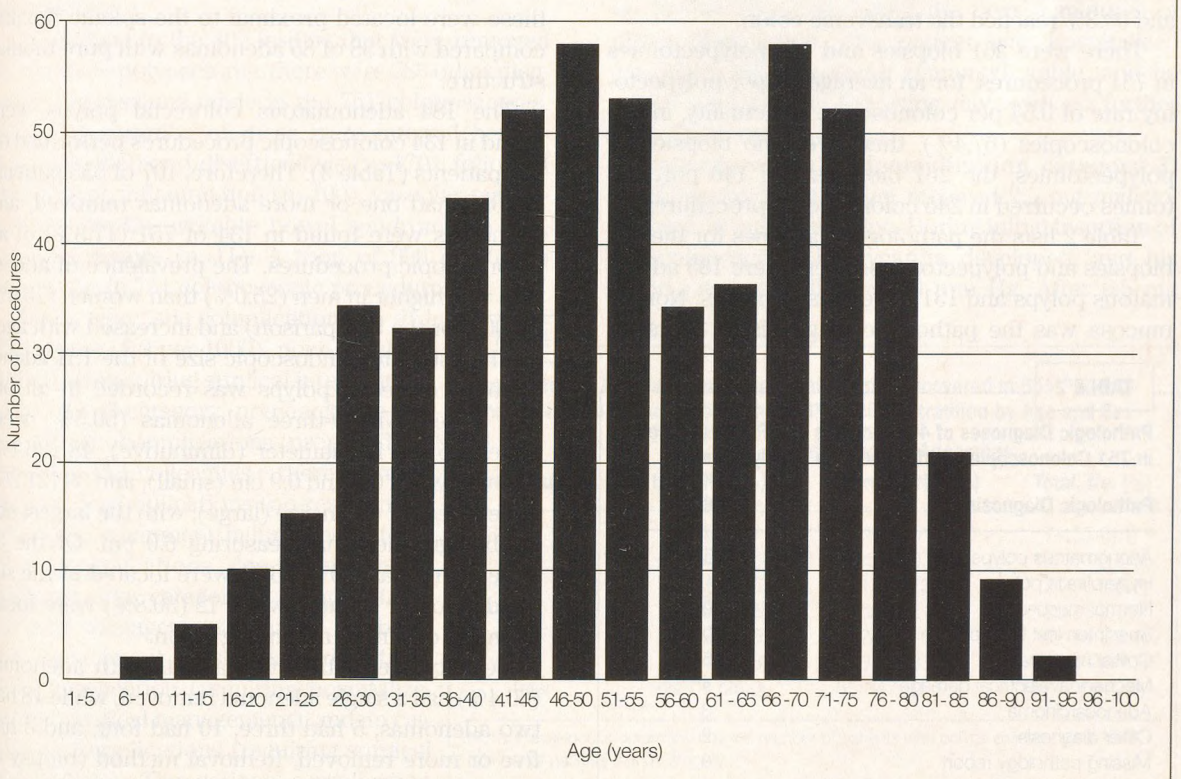


TABLE 1

Indications for Colonoscopy in 751 Procedures Performed by a Family Physician.

Indications for Colonoscopy	Procedures with Indication No. (%)
Gastrointestinal bleeding	375 (49.9)
Polyp follow-up	157 (20.9)
Abdominal pain	88 (11.7)
Diarrhea	87 (11.6)
Abnormal findings on flexible sigmoidoscopy	63 (8.4)
Anemia	37 (4.9)
Abnormal colon radiograph	17 (2.3)
Change in bowel habits	10 (1.3)
Constipation	10 (1.3)
Family history of colon cancer	9 (1.2)
Others	33 (4.4)

NOTE: Patients could have more than one indication for colonoscopy.

the most common reasons were poor bowel preparation (n=16), patient discomfort or lack of cooperation (n=13), adhesions, prior abdominal surgery, or radiation (n=9), and inability to fully insert the scope (n=7). Of the 751 procedures, 91.5% were intubated to the cecum, 94.1% reached the ascending colon, and 99.3% reached the transverse colon.

There were 261 biopsies and 146 polypectomies in 751 procedures, for an average biopsy/polypectomy rate of 0.54 per colonoscopy. In actuality, in 506 colonoscopies (67.4%), there were no biopsies or polypectomies; the 261 biopsies and 146 polypectomies occurred in 245 colonoscopic procedures.

Table 2 lists the pathologic diagnoses for the 407 biopsies and polypectomies. There were 185 adenomatous polyps and 131 hyperplastic polyps. Normal mucosa was the pathologic diagnosis in 39 cases, and in 20 instances, the specimen was lost in the colon.

TABLE 2

Pathologic Diagnoses of 407 Biopsies and Polypectomies in 751 Colonoscopies Performed by a Family Physician

Pathologic Diagnosis	Number
Adenomatous polyps	185
Hyperplastic polyps	131
Normal mucosa	39
Specimen lost in colon	20
Colitis/inflammation	15
Mechanical/electrical damage	4
Adenocarcinoma	3
Other diagnosis	2
Missing pathology report	8

Three adenocarcinomas were discovered in 751 colonoscopies (0.4%). Only one was within reach of flexible sigmoidoscopy, and neither patient with a proximal cancer had at the same time a benign adenomatous polyp. In addition to the three hemicolectomies performed to treat the adenocarcinomas, four other patients underwent colon surgery for large, benign sessile adenomas.

Of the 185 adenomatous polyps discovered and removed at colonoscopy, 184 were in the rectum and colon, and one was in the ileum (Figure 2). The most common site for an adenoma was the sigmoid colon (33%), followed by the ascending colon (15%) and the cecum (14%). Of 184 adenomas, 45% were within reach of flexible sigmoidoscopy, if one excludes descending colon lesions, or 58% if descending colon lesions are included. Ten adenomatous polyps had a pure villous structure on pathologic examination, and 7 of these were located proximal to the splenic flexure, compared with 38 of 85 adenomas with pure tubular structure.

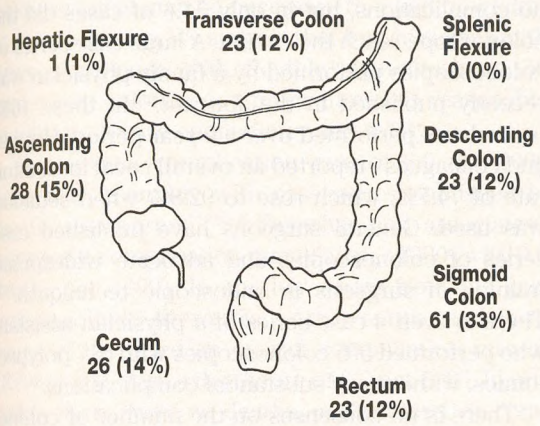
The 184 adenomatous colorectal polyps were found in 134 colonoscopic procedures performed on 107 patients (Table 3). Therefore, 107 of 555 patients (19.3%) had one or more adenomas removed, and adenomas were found in 134 of 751 (17.8%) of all colonoscopic procedures. The prevalence of adenomas was higher in men (25.0%) than women (15.9%, P=.008 for the comparison) and increased with age.

The estimated endoscopic size of the 184 adenomatous colorectal polyps was recorded in all but four cases. Ninety-three adenomas (50.5%) were under 0.5 cm in diameter (diminutive), 48 (26.1%) were between 0.5 and 0.9 cm (small), and 39 (21.2%) were at least 1 cm in size (large), with the largest single benign adenoma measuring 6.0 cm. Of the 39 large adenomas, 20 (51.3%) were located in the sigmoid colon or rectum, while 12 (30.8%) were located in the cecum or ascending colon.

Seventy-one of the 107 patients with adenomas (66.4%) had a single adenoma removed, while 18 had two adenomas, 5 had three, 10 had four, and 3 had five or more removed. Removal method (biopsy or polypectomy) was available for the 180 adenomas

FIGURE 2

Distribution of 184 adenomatous colorectal polyps discovered at colonoscopy by a family physician.



with a recorded size. Ninety-eight adenomas (54.4%) were removed by biopsy, while 82 (45.6%) were removed by polypectomy. A greater proportion of larger adenomas (74.4%) and small polyps (66.7%) than diminutive polyps (22.6%) were removed by polypectomy.

In addition to the 407 lesions that were removed by biopsy or polypectomy, there were 583 other diagnostic impressions made in the 751 colonoscopies. The most common of these were internal hemorrhoids (n=209) and diverticulosis (n=170), followed by colitis or inflammation (n=100), vascular malformations (n=32), irritable bowel syndrome (n=23), and anal fissure (n=11). A total of 990 diagnoses were made in 751 colonoscopic procedures.

There were six complications in 751 procedures (8.0 per 1000), none resulting in death or requiring surgical intervention. Using the 5-category nomenclature for endoscopic complications proposed by Fleischer and colleagues,[10] there were no category 1 complications (no real complication, eg, equipment failure), no category 2 complications (no management required), five category 3 complications (medical management required, all related to intravenous anesthesia), one category 4 complication (requiring hospitalization for medical management), and no category 5 complications (requiring surgical intervention). The serious complication rate (category 3 or higher) was 8.0 per 1000.

The six cases with complications are as follows, representing categories 3 and 4:

Procedure No. 20 [complication category 3]. A 61-year-old white man received 5 mg midazolam and 75 mg meperidine. Oxygen saturation dropped to 76%; it returned to normal after the patient received naloxone. Respirations, pulse, and blood pressure remained normal.

Procedure No. 28 [complication category 3]. A 78-year-old white man received 6.25 mg midazolam and 100 mg meperidine. After multiple polypectomies, his pulse rate fell to 46 beats per minute, and his blood pressure fell but remained above 100 mm Hg systolic. After naloxone, his pulse rate improved to 70 beats per minute and his systolic blood pressure rose to 150 mm Hg.

Procedure No. 32 [complication category 4]. A 65-year-old white man had multiple polypectomies. A 6-mm pedunculated polyp in the distal descending colon was snared with the use of a blended cutting-coagulation current. The stump continued to ooze, and after observation, cautery was reapplied using coagulation current only. There was no further bleeding during the next 5 minutes of direct observation. The patient was hospitalized overnight; his hematocrit remained stable, and he was discharged the following day, with no further complications.

Procedure No. 44 [complication category 3] An 80-year-old white man received 2.5 mg midazolam and 50 mg meperidine. During initial insertion of the colonoscope, bradycardia developed, and his blood pressure fell to 80/40 mm Hg. After 0.5 mg

TABLE 3

Prevalence of Adenomatous Colorectal Polyps Discovered in 555 Patients Undergoing Colonoscopy by a Family Physician, Stratified by Age and Sex

	Prevalence of Adenomas		
Age Group, y	Men, No. (%)	Women, No. (%)	Total, No. (%)
0-39	4/55 (7.3)	3/82 (3.7)	7/137 (5.1)
40-49	12/48 (25.0)	6/55 (10.9)	18/103 (17.5)
50-59	10/43 (23.5)	11/47 (23.4)	21/90 (23.3)
60-69	13/29 (44.8)	13/62 (21.0)	26/91 (28.6)
70-79	10/22 (45.5)	12/71 (16.9)	22/93 (23.7)
80+	3/11 (27.3)	10/30 (33.3)	13/41 (31.7)
Total	52/208 (25.0)	55/347 (15.9)	107/555 (19.3)

NOTE: Prevalence is determined by the number of patients with polyps divided by the total number of patients in the category.

atropine, the pulse increased to 108 beats per minute and the blood pressure rose to 110/70 mm Hg. The scope was inserted to the cecum, where biopsies were performed. His blood pressure again fell and responded promptly to atropine and naloxone. The scope was removed, and there were no further complications.

Procedure No. 108 [complication category 3]. A 66-year-old white woman received 7.5 mg midazolam and 75 mg meperidine. There was difficulty passing the colonoscope through the transverse colon. Her blood pressure fell to 80/40 mm Hg and oxygen saturation fell to 88%; her pulse rate remained normal (96 beats per minute). The procedure was discontinued, and she was treated with intravenous normal saline. Her blood pressure and oxygen saturation normalized, and she had no further complications.

Procedure No. 661 [complication category 3]. A 65-year-old white woman received 3 mg midazolam and 25 mg meperidine. She developed erythema and swelling at the intravenous site, which resolved promptly with intravenous diphenhydramine. There were no pulmonary symptoms; her vital signs remained normal.

Five of the six complications occurred during the first 18 months of the study period. In addition to increased operator experience, the mean dosage of intravenous sedation dropped substantially during the study period, especially the use of meperidine. We did not record procedure time in this study, but the first author now schedules 30 minutes for colonoscopy, whereas he originally required 60 minutes.

DISCUSSION

Family physicians and other primary care physicians frequently perform flexible sigmoidoscopy. The major indication for this procedure in primary care is screening for colorectal malignancy, and many expert groups, including the US Preventive Services Task Force, recommend routine sigmoidoscopic screening.[12] There is substantial medical literature on training family physicians for flexible sigmoidoscopy,[13-23] and even nonphysicians have been trained to perform this procedure.[24]

There is less literature regarding performance of colonoscopy with polypectomy by primary care physicians. Godreau,[25] a family physician, reported on 157 office-based colonoscopies in which 113 polyps were found. He reached the cecum in 83% of cases and experienced no complications. Rodney and co-authors[26] described 293 colonoscopies with no complications, but in only 54% of cases did the colonoscope reach the cecum. A large case series of colonoscopies performed by a family physician was recently published in the *Journal*.[27] In these 1048 procedures performed over a 9-year period, Hopper and colleagues[27] reported an overall cecal intubation rate of 74.7%, which rose to 92.8% when sedation was used. General surgeons have published case series of colonoscopies and advocate widespread training of surgeons in endoscopic techniques.[28,29] There is even a case series of a physician assistant who performed 505 colonoscopies with 617 polypectomies, without any substantial complications.[30]

There is no consensus on the number of colonoscopies and the knowledge base required to attain competence in colonoscopy. The American College of Physicians has suggested that 50 supervised procedures is enough, including 15 polypectomies,[31] but other experts find that even 100 to 120 may not be enough.[32-36] Recent GI textbooks are either silent on this topic or suggest that a specific number of precepted procedures is difficult to justify, and that individuals should be certified as competent on the basis of their specific skills.[37-39] Waye[40] suggests that "one method for obtaining skills in a post-training situation is to locate a proficient colonoscopist and form a teaching relationship with that person as a preceptor for 50 to 100 colonoscopic examinations."

In the study reported here, the first author achieved total colonoscopy, meaning intubation to the cecum, in 91.5% of colonoscopic procedures. This success rate is higher than other series from primary care physicians[25-27] and is comparable to the results obtained by gastroenterologists and other specialists.[41-44] Waye, in a 1995 gastroenterology textbook,[38] states that "a trained endoscopist should be able to perform total colonoscopy to the cecum in more than 90% of patients within 30 to 45 minutes."

Our case series documents that a family physician can acquire colonoscopic skills, including polypectomy, after completing family practice residency training. Unlike other reports, we did not demonstrate any "training effect" regarding success in intubating the cecum.[35] This may be because this family physician had thoroughly mastered flexible sigmoidoscopy before training in colonoscopy. We did note,

however, that the complication rate was higher in the first 120 procedures, with only a single complication in the last several hundred colonoscopies. This observation suggests that a certain number of colonoscopies may be necessary to avoid procedural complications. We suggest that for physicians with prior experience with flexible sigmoidoscopy, 50 supervised colonoscopy procedures is a reasonable number to assure competency and safety.

Our overall complication rate of 8.0 per 1000 compares favorably with case series published in the GI literature.[10,37-39,45,46] Fleischer and associates[10] reported a complication rate of 19 per 1000 (with 0.6 deaths per 1000). In another series from the gastroenterology literature, Arrowsmith and colleagues[45] recorded an overall complication rate of 13.5 per 100, with a death rate of 0.3 per 1000. In our series, there were no deaths, perforations, or complications requiring surgical intervention. There was only one major endoscopic complication, oozing from a polypectomy stump, and this problem resolved with overnight hospitalization and without blood transfusion. There were no episodes of delayed postpolypectomy bleeding in 146 polypectomies (the literature suggests the acceptable rate of this complication is approximately 1.5%).[38,40] Four of the five anesthesia-related complications were seen in the first 18 months. We suggest that the lower mean dosages of intravenous sedation and possibly operator experience may have contributed to there being only one anesthesia-related complication in the last 643 procedures.

The diagnostic yield, particularly of adenocarcinomas, was considerably lower than has been seen in case series reported by gastroenterologists. For example, in one series of 1172 colonoscopies performed for bleeding or abdominal symptoms, 7.8% had colorectal cancer.[42] In studies examining screening colonoscopy performed in asymptomatic patients, the yield of colon cancer has usually been about 1%, with one study reporting 3.4%.[41,47-51] We found only three colorectal cancers in 751 procedures (0.4%). This result is probably not due to inadequate examination, as 91.5% of patients were examined to the cecum or beyond. It is possible that patients seen in a primary care practice with indications for colonoscopy represent a healthier population than the patients typically seen by gastroenterologists or other specialists. It is also possible that colorectal malignancy was actually prevented by removal of precursor adenomatous polyps.[52] This low incidence of colorectal malignancy may be partially due to the first author's emphasis on colorectal cancer screening with annual fecal occult blood tests and every third year flexible sigmoidoscopy for patients over 50 years of age. Continued follow-up will establish whether any existing colorectal malignancies were not detected.

The most common reason for the family physician in this study to perform colonoscopy was GI bleeding; other common reasons were polyp follow-up, abdominal pain, and diarrhea. As a physician does more colonoscopies, the number of procedures done to follow up prior adenomatous polyps will increase, as up to 30% of patients over the age of 50 years have at least one adenomatous polyp in their colons.[9,53-55]

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