ORIGINAL ARTICLE

Colonoscopic Withdrawal Times and Adenoma Detection during Screening Colonoscopy

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ABSTRACT

BACKGROUND

Colonoscopy is commonly used to screen for neoplasia. To assess the performance of screening colonoscopy in everyday practice, we conducted a study of the rates of detection of adenomas and the amount of time taken to withdraw the colonoscope among endoscopists in a large community-based practice.

METHODS

During a 15-month period, 12 experienced gastroenterologists performed 7882 colonoscopies, of which 2053 were screening examinations in subjects who had not previously undergone colonoscopy. We recorded the numbers, sizes, and histologic features of the neoplastic lesions detected during screening, as well as the duration of insertion and of withdrawal of the colonoscope during the procedure. We compared rates of detection of neoplastic lesions among gastroenterologists who had mean colonoscopic withdrawal times of less than 6 minutes with the rates of those who had mean withdrawal times of 6 minutes or more. According to experts, 6 minutes is the minimum length of time to allow adequate inspection during instrument withdrawal.

RESULTS

Neoplastic lesions (mostly adenomatous polyps) were detected in 23.5% of screened subjects. There were large differences among gastroenterologists in the rates of detection of adenomas (range of the mean number of lesions per subject screened, 0.10 to 1.05; range of the percentage of subjects with adenomas, 9.4 to 32.7%) and in their times of withdrawal of the colonoscope from the cecum to the anus (range, 3.1 to 16.8 minutes for procedures during which no polyps were removed). As compared with colonoscopists with mean withdrawal times of less than 6 minutes, those with mean withdrawal times of 6 minutes or more had higher rates of detection of any neoplasia (28.3% vs. 11.8%, P<0.001) and of advanced neoplasia (6.4% vs. 2.6%, P=0.005).

CONCLUSIONS

In this large community-based gastroenterology practice, we observed greater rates of detection of adenomas among endoscopists who had longer mean times for withdrawal of the colonoscope. The effect of variation in withdrawal times on lesion detection and the prevention of colorectal cancer in the context of widespread colonoscopic screening is not known. Ours was a preliminary study, so the generalizability and implications for clinical practice need to be determined by future studies.

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IN RECENT YEARS, COLONOSCOPY HAS BE-come increasingly common as a screening test for colorectal neoplasia.[1,2] In part, this trend reflects a growing belief that colonoscopy is effective at reducing complications and death from colorectal cancer. Large prospective studies have shown substantial reductions in the expected risk of colorectal cancer during long-term follow-up after screening colonoscopy.[3-5] However, the magnitude of the estimated benefit of colonoscopy, in comparison with reference populations, has varied among studies. In the National Polyp Study, the estimated reduction in the incidence of colorectal cancer ranged from 76 to 90% over a prolonged period of surveillance after colonoscopic polypectomy.[3] Large case–control studies of screening colonoscopy[5] and flexible sigmoidoscopy[6] have shown a 50% reduction in the incidence of cancer within the examined segment of colorectum. Potential reasons for these differences in percentages include variations among study subjects or reference populations and variability of the screening procedure to detect lesions that are present.

Colonoscopy affords an opportunity to remove benign adenomatous polyps before they progress and become cancerous.[7] However, there are limitations in the ability of endoscopists to identify neoplasia. For example, repeated colonoscopy[8] or colonography by means of computed tomography[9] performed in close succession to colonoscopy can identify neoplastic lesions that were not detected during the initial procedure. In addition, interexaminer differences in the detection of polyps have been shown in population-based studies of screening colonoscopy[10] and screening flexible sigmoidoscopy.[11,12]

Differences among examiners in the rates of detection of adenomas may be related to the procedural technique used during withdrawal of the colonoscope,[13] which is considered the critical phase at which to assess for neoplasia. We hypothesized that the more time endoscopists devoted to examining the colorectal mucosa — that is, the longer the period of instrument withdrawal — the more neoplastic lesions they would identify. To monitor the quality of colonoscopy in our practice, we studied the rates of detection of neoplasia and the duration of colonoscopic withdrawal during screening colonoscopy by endoscopists in our practice.

METHODS

We conducted this study during routine clinical examinations in a large community-based gastroenterology practice. Although the physicians in this practice have clinical appointments at the University of Illinois College of Medicine at Rockford, their day-to-day functions closely resemble those of a private, community-based gastroenterology practice. The institutional review board at the University of Illinois approved the study. Since this project examined quality control in our routine clinical practice, the review board waived the need for informed consent. However, as part of the routine consent for endoscopic procedures, we informed subjects that data might be collected to monitor the quality of our practice.

STUDY POPULATION

The study population consisted of consecutive subjects who underwent screening colonoscopy in our ambulatory surgery center from January 1, 2003, to March 31, 2004. Subjects were either directly scheduled or had screening colonoscopy scheduled during a previous visit to the gastroenterology clinic for an unrelated issue. Subjects had no symptoms of colonic disorders. Subjects who had undergone colonoscopy previously, whose insurance mandated a hospital procedure, or who had a history of colorectal neoplasia were not included. These restrictions, and the large volume of diagnostic procedures we perform, limited the number of screening subjects (Fig. 1).

STUDY PROCEDURES

We performed colonoscopies during standard 30-minute time slots. Twelve full-time, board-certified gastroenterologists, all of whom had dedicated, hands-on colonoscopic instruction as part of their fellowship training in gastroenterology, performed the procedures. Each endoscopist had performed a minimum of 3000 colonoscopies before this study began. Endoscopists used adult or pediatric variable-stiffness video colonoscopes (Olympus America). The standard bowel preparation was a three-dose oral regimen of aqueous sodium phosphate (Fleet Phospho-soda, C.B. Fleet), described previously,[14] or a 3.8-liter oral lavage of polyethylene glycol electrolyte solution (Nulytely, Braintree Laboratories) if there were contraindications to sodium phosphate.[14] Subjects received
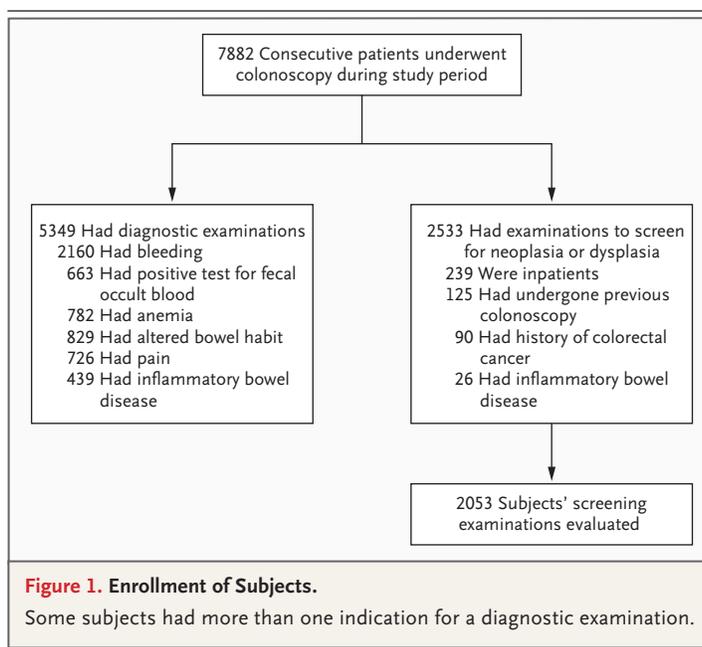
conscious sedation with intravenous midazolam plus fentanyl or meperidine.

Endoscopists were aware that a study examining colonoscopic techniques, including procedure times, was being conducted. They gave oral consent for participation in the study before its onset. The endoscopy nurse recorded times for the following procedural events: colonoscope insertion into the rectum, identification of the base of the cecum, and withdrawal of the colonoscope across the anus, with times rounded to the nearest minute. The number, locations, and method of removal of polyps were likewise recorded. We defined colonoscopic insertion time as the time from insertion into the rectum to identification of the base of the cecum and withdrawal time as the time from cecal identification to the time when the colonoscope was withdrawn across the anus. This withdrawal time included time taken for maneuvers such as polypectomy that were performed during the withdrawal phase of the examination. We estimated the sizes of lesions at the time of colonoscopy by in vivo comparison with two standard endoscopic instruments — an open-biopsy forceps (7 mm) or the diameter of the outer sheath of a polypectomy snare (3 mm). We confirmed the size of lesions that were 10 mm or more in diameter by means of histopathological analysis or examination of surgical specimens for intact lesions; otherwise, we used the endoscopic estimate.

STATISTICAL ANALYSIS

The primary outcome measure was the rate of adenoma detection of each endoscopist, calculated alternately as the total number of neoplastic lesions detected divided by the number of subjects screened and as the proportion of subjects with at least one neoplastic lesion. We also calculated the rates of detection of advanced lesions (i.e., adenomas 10 mm or more in diameter, lesions with a villous component, high-grade dysplasia, or cancer) and of hyperplastic lesions. The unit of analysis was the physician, not the subject.

Since current literature and expert opinion[15,16] suggest 6 minutes as the minimum adequate mean withdrawal time for screening colonoscopy in which no polyps are removed, we used this value to distinguish endoscopists who had a withdrawal time that was relatively fast (less than 6 minutes) or slow (6 minutes or more). We used

Figure 1. Enrollment of Subjects.

Some subjects had more than one indication for a diagnostic examination.

Student's t-test to test for differences in the rates of detection of lesions between endoscopists who had a mean withdrawal time of less than 6 minutes and those who had a mean withdrawal time of 6 minutes or more. We used the chi-square test to analyze categorical data. Data are reported as means ±SD unless otherwise noted.

To control for the possible lengthening of withdrawal time due to the removal of — rather than the assessment for — polyps, we calculated withdrawal times for procedures involving the removal of polyps and for those in which no polyps were manipulated (i.e., procedures involving neither removal nor biopsy of a polyp). We used the Spearman rank-correlation coefficient to measure the relationship between the mean withdrawal times and lesion-detection rates of the endoscopists. Statistical tests were performed with the use of SPSS software, version 12.0.

RESULTS

STUDY POPULATION

Table 1 shows the baseline characteristics of the physicians and the study subjects, displayed as the screening cohorts of the individual endoscopists and compared according to mean withdrawal time (for colonoscopies with no polyps removed) of less than 6 minutes or of 6 minutes or more. Of 7882

Table 1. Baseline Characteristics of the Physicians and Subjects.*

Physician	No. of Colonoscopies Performed Annually	Sample Size		Subject Characteristics			
			Age	Male Sex	Family History of Colorectal Cancer	Excellent or Good Bowel Preparation	Cecal Intubation
		no. (%)	*yr*		*no. (%)*		
A	795	224 (28)	60.4±9.7	101 (45)	23 (10)	211 (94)	220 (98)
B	712	163 (23)	58.8±7.9	86 (53)	20 (12)	154 (94)	161 (99)
C	479	153 (32)	59.7±7.5	83 (54)	12 (8)	136 (89)	149 (97)
D	847	212 (25)	60.1±8.2	105 (50)	13 (6)	200 (94)	211 (100)
E	674	138 (20)	61.4±8.6	61 (44)	13 (9)	130 (94)	134 (97)
F	651	232 (36)	59.9±8.9	113 (49)	31 (13)	214 (92)	230 (99)
G	648	138 (21)	60.4±9.0	75 (54)	15 (11)	129 (93)	137 (99)
H	704	133 (19)	61.7±8.8	66 (50)	11 (8)	126 (95)	130 (98)
I	886	245 (28)	60.2±8.9	128 (52)	25 (10)	232 (95)	243 (99)
J	623	165 (26)	60.2±8.8	83 (50)	19 (12)	150 (91)	163 (99)
K	685	132 (19)	60.9±8.3	78 (59)	9 (7)	127 (96)	132 (100)
L	521	118 (23)	61.4±8.9	65 (55)	9 (8)	104 (88)	118 (100)
Mean Withdrawal Time†							
					no./total no. (%)		
Less than 6 min (N=3)	662.0±163.8	180.0±38.4 (27.7±4.5)	59.7±8.6	270/540 (50)	55/540 (10)	501/540 (93)	530/540 (98)
6 min or more (N=9)	693.2±111.7	168.1±48.5 (24.2±5.3)	60.5±8.7	774/1513 (51)	145/1513 (10)	1412/1513 (93)	1498/1513 (99)
Total (N=12)	685.4±119.0	171.1±44.8 (25.0±5.2)	60.3±8.7	1044/2053 (51)	200/2053 (10)	1913/2053 (93)	2028/2053 (99)
P value‡	0.71	0.71 0.33	0.06	0.65	0.69	0.67	0.12

* Plus–minus values are means ±SD.
† The mean withdrawal time was for colonoscopies during which no polyps were removed.
‡ Student's t-test was used to test for differences between the physicians with a mean withdrawal time under 6 minutes and those with a mean time of 6 minutes or more. The chi-square test was used for categorical data. None of the differences were significant.

colonoscopies performed during the study period, 5349 were for diagnostic indications and 2533 were for screening. Of the screening subjects, 239 were inpatients, 125 had undergone previous colonoscopy, 90 had a history of colorectal cancer, and 26 had inflammatory bowel disease. These 480 subjects were excluded, and the remaining 2053 constituted the study population (Fig. 1). The mean number of screening colonoscopies that each endoscopist performed during the study period was 171±45. There were no significant differences in the ages of the physicians or of the subjects, procedural volume, prevalence of family history of colorectal cancer, the quality of bowel preparation, or the rates of cecal intubation between endoscopists who had a mean withdrawal time of less than 6 minutes as compared with those who had a withdrawal time of 6 minutes or more. Endoscopists whose withdrawal times were less than 6 minutes had a mean age of 54.0±5.2 years and had a mean of 20.7±6.8 years of clinical experience in gastroenterology. Endoscopists whose withdrawal times were 6 minutes or more had a mean age of 45.9±7.9 (P=0.13) and had a mean of 13.3±8.5 years of clinical experience (P=0.21).

OUTCOME MEASURES

Table 2 shows the procedure times and the lesion-detection rates for each endoscopist. The mean colonoscopic insertion time was 7.2±4.4 minutes. The overall mean withdrawal time for examina-

tions in which no polyps were removed was 6.3±3.9 minutes (range, 3.1 to 16.8) as compared with 10.6±5.8 minutes for procedures during which polyps were removed (range, 5.6 to 19.1). We detected adenomatous polyps in 23.5% of subjects (range, 9.4 to 32.7). The mean overall rate of detection of adenomas was 0.47 lesion per subject (range, 0.10 to 1.05). The overall advanced adenoma detection rate was 0.06 lesion per subject (range, 0.01 to 0.10). We detected hyperplastic lesions in 21.4% of subjects (range, 5.5 to 55.1).

We found strong relationships between withdrawal times and lesion-detection rates, regardless of whether polyps or masses were manipulated (Table 3). Direct correlations between withdrawal times for procedures without polyp removal and the detection of lesions were strongest for all adenomas (r_s=0.90, P<0.001), for the percentage of subjects with any adenomas (r_s=0.82, P=0.001), and for hyperplastic lesions (r_s=0.80, P=0.002). However, withdrawal times for procedures without polyp removal also correlated directly with the detection of advanced lesions (r_s=0.66, P=0.02). For procedures in which polyps were removed, there was an inverse correlation between withdrawal times and mean polyp size (r_s=−0.63, P=0.03) and a positive correlation between longer withdrawal times and the removal of polyps that were less than 5 mm in diameter (r_s=0.59, P=0.04). However, these relationships were not statistically significant for the analysis of withdrawal times during procedures in which no polyps were removed. Table 4 shows the rates of detection of lesions for endoscopists stratified according to whether their mean withdrawal time for procedures without polyps was less than 6 minutes or was 6 minutes or more. Rates of detection of adenomas, advanced adenomas, and hyperplastic lesions were all significantly greater among endoscopists whose mean withdrawal time was 6 minutes or more. The overall rate of detection of adenomas among endoscopists who had relatively slow mean withdrawal times was nearly four times as great as the rate among endoscopists who had relatively fast withdrawal times.

ADVANCED NEOPLASMS

A total of 113 advanced neoplasms were identified in 107 of 2053 subjects (5.2%) who were screened — 101 lesions had a diameter of 10 mm or more, 37 had villous histologic features, 3 had high-grade dysplasia, and 9 were cancers. (Some ade-

Table 2. Withdrawal Times and Rates of Detection of Lesions for Individual Physicians.*

Physician	No. of Colonoscopies	Insertion Time (minutes)	Withdrawal Time for Procedures in Which Polyps Were Removed (minutes)	Withdrawal Time for Procedures with No Polyps Removed (minutes)	Polyp Size (mm)	Polyps <5 mm in Diameter (%)	Subjects with Adenomas† (%)	No. of Adenomas per Subject Screened†	Subjects with Advanced Adenomas‡ (%)	No. of Advanced Adenomas per Subject Screened‡	Subjects with Hyperplasia (%)
A	224	6.7±3.4	5.6±3.0	3.1±1.6	5.2±3.3	39.4	9.4	0.10	1.3	0.01	13.4
B	163	8.3±5.7	6.8±4.3	3.8±1.7	5.3±5.2	69.6	12.3	0.17	3.1	0.03	5.5
C	153	8.4±4.0	8.0±5.0	4.1±1.8	4.9±2.8	62.7	13.7	0.25	3.3	0.03	11.8
D	212	5.3±3.0	8.2±2.9	6.5±1.8	5.4±3.6	47.3	24.1	0.42	6.6	0.07	24.1
E	138	7.9±4.1	10.0±4.2	7.0±2.5	4.0±3.4	74.8	22.5	0.46	4.4	0.04	21.7
F	232	10.5±5.6	9.2±5.8	6.3±4.1	3.8±3.4	78.3	25.4	0.50	5.2	0.05	20.7
G	138	6.1±3.0	8.6±3.6	6.1±2.4	5.6±3.2	41.4	28.3	0.52	8.0	0.08	23.9
H	133	7.1±3.4	10.8±4.9	7.9±2.6	5.2±5.6	67.6	32.3	0.53	8.3	0.09	28.6
I	245	5.8±2.8	9.6±4.4	7.0±2.6	4.2±3.6	67.3	25.7	0.54	4.9	0.06	20.0
J	165	7.2±4.7	12.6±5.0	9.8±4.0	4.6±2.9	62.5	32.7	0.60	4.8	0.05	21.8
K	132	6.7±5.4	13.2±4.4	11.8±3.7	4.4±3.9	74.9	31.8	0.83	9.1	0.10	25.0
L	118	6.1±3.6	19.1±6.0	16.8±5.3	3.5±2.9	82.0	32.2	1.05	6.8	0.08	55.1
Total	2053	7.2±4.4	10.6±5.8	6.3±3.9	4.5±3.7	66.6	23.5	0.47	5.2	0.06	21.4

* Plus–minus values are means ±SD.
† This category includes tubular adenomas, tubulovillous adenomas, villous adenomas, and cancer.
‡ Advanced adenomas include those with a diameter of at least 10 mm, villous histologic features, high-grade dysplasia, and cancer.

Table 3. Relationships between Variables and Withdrawal Times, According to Removal or No Removal of Polyps during Colonoscopy.

Variable	No Polyps Removed		Polyps Removed	
	Correlation Coefficient*	P Value	Correlation Coefficient*	P Value
Mean polyp size	−0.57	0.05	−0.63	0.03
Percentage of polyps smaller than 5 mm in diameter	0.54	0.07	0.59	0.04
Percentage of subjects with adenomas†	0.82	0.001	0.85	<0.001
No. of adenomas per subject screened†	0.90	<0.001	0.94	<0.001
Percentage of subjects with advanced neoplasia‡	0.65	0.02	0.66	0.02
No. of advanced neoplastic lesions per subject screened‡	0.66	0.02	0.66	0.02
Percentage of subjects with hyperplasia	0.80	0.002	0.76	0.004

* Values are Spearman rank-correlation coefficients (two-sided), calculated by comparing lesion variables and mean withdrawal times in examinations performed by 12 endoscopists.
† This category includes tubular adenomas, tubulovillous adenomas, villous adenomas, and cancer.
‡ Advanced neoplastic lesions include those with a diameter of at least 10 mm, villous histologic features, high-grade dysplasia, and cancer.

nomas fell into more than one category; e.g., some adenomas exceeding 10 mm in diameter also had villous histologic features.) The three endoscopists whose mean withdrawal times were less than 6 minutes identified 13 advanced lesions among 540 subjects (2.6%). The remaining 100 advanced lesions were detected in 1513 subjects by the nine endoscopists whose mean withdrawal times were 6 minutes or more (6.4%). This difference was statistically significant (P=0.005) (Table 4). Of the nine malignant lesions detected, only one was detected by an endoscopist with a mean withdrawal time of less than 6 minutes; the other eight were detected by endoscopists with withdrawal times of 6 minutes or more (P=0.30) (Table 4). One adenomatous polyp that had high-grade dysplasia measured 5 mm in diameter; another adenomatous polyp, characterized by invasive cancer, measured 7 mm. Both these lesions were detected by endoscopists whose mean withdrawal times were 6 minutes or more.

Figure 2 shows the mean rate of detection of adenomas by individual endoscopists, plotted against their mean colonoscopic withdrawal times for procedures in which no polyps were removed. This graph highlights the strong correlation between withdrawal times and the rate of detection of adenomas. The Supplementary Appendix (available with the full text of this article at www.nejm.org) displays frequencies of colonoscopies as compared with colonoscopic withdrawal times for individual endoscopists A through L, according to increasing mean withdrawal time for procedures in which no polyps were removed.

DISCUSSION

Physicians and patients have embraced colonoscopy as an effective preventive measure against colorectal cancer. For example, the American College of Gastroenterology recommends colonoscopy as the preferred screening strategy for colorectal neoplasia.[17] However, there are few reliable indicators of how well this procedure is performed in everyday practice, particularly with respect to the crucial goals of the identification and removal of neoplastic lesions. Our analysis of screening colonoscopy in a predominantly average-risk population unveiled significant variation in the rates of detection of neoplasia among experienced endoscopists. Although differences in the rates of detection did not seem to be related to baseline characteristics of the subjects, the age or experience of the physicians, or the adequacy of bowel preparation, it is possible that chance differences in risk factors for colorectal neoplasia that were not measured (e.g., a history of smoking, a history of breast cancer, and black race) contributed to differences among examiners in the detection of neoplasia.

However, our findings suggest that variation in colonoscopic withdrawal times contributes to differences in the rates of detection of neoplasia among gastroenterologists. We observed a strik-

Table 4. Rates of Detection of Lesions According to Mean Withdrawal Time for Procedures in Which No Polyps Were Removed.*

Variable	All Physicians (N = 12)	Less Than 6 Minutes (N = 3)	6 Minutes or Longer (N = 9)	P Value†
Subjects with adenomas (%)	24.2±8.3	11.8±2.2	28.3±4.0	<0.001
Adenomas per subject screened (no.)	0.50±0.26	0.17±0.07	0.61±0.20	0.006
Subjects with advanced neoplasia (%)	5.5±2.3	2.6±1.1	6.4±1.7	0.005
Advanced neoplastic lesions per subject screened (no.)	0.06±0.03	0.03±0.01	0.07±0.02	0.005
Cancers per subject screened (no.)	0.005±0.005	0.002±0.004	0.006±0.005	0.30
Subjects with hyperplasia (%)	22.6±12.1	10.2±4.2	26.8±10.9	0.03

* Plus–minus values are means ±SD. Overall group mean values in this table denote aggregate summary means of 12 physicians, whereas overall means in Table 2 denote true means of individual subjects.
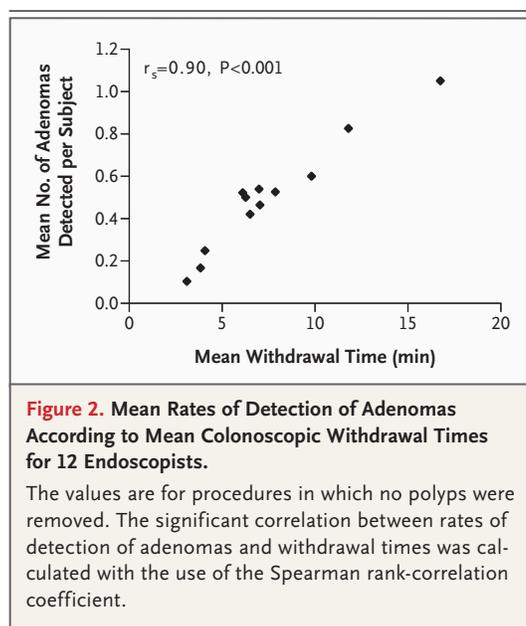† P values were calculated with the use of Student's t-test.

ing, seemingly linear relationship between colonoscopic withdrawal times and rates of neoplasia detection. In addition, we found that longer withdrawal times correlated with increased rates of detection of advanced neoplasia. When categorized according to a mean withdrawal time of either less than 6 minutes or 6 minutes or more (6 minutes is a recommended estimate of the time necessary for adequate inspection in normal colons[15,16]), we observed that the rates of detection of advanced neoplasms were significantly greater for endoscopists who had longer mean procedure withdrawal times than for those who had shorter withdrawal times. The rate of detection of cancer paralleled this trend; however, we had limited power because of the small number of cancers, and this difference was not statistically significant.

The strong association between the neoplasia-detection rates of individual colonoscopists and colonoscopic withdrawal time was evident for all procedures as well as for those in which no polyps were detected. Because the additional time required to remove more polyps may have contributed to a longer withdrawal time, withdrawal times for procedures in which no polyps were detected may represent mucosal inspection times more accurately. Longer withdrawal times may reflect time spent looking for relatively small polyps. For procedures in which polyps were removed, we observed an inverse correlation between mean withdrawal time and mean polyp size, as well as a weak direct correlation between withdrawal time and the incidence of diminutive polyps. However, these relationships were not statistically significant in the analysis of withdrawal times for procedures in which no polyps were removed. This implies that part of the effect of increased detection of adenomas by endoscopists with slower withdrawal times was attributable to detection of more than just diminutive lesions.

We did not assess the specifics of mucosal inspection during colonoscopy, but it seems reasonable to suspect that endoscopists who take longer to withdraw the instrument also use techniques that improve visualization of neoplastic lesions. A study of two endoscopists with different rates of missed adenomas showed that careful methods of inspection coincided with a longer mean withdrawal time.[13] Thus, a relatively long withdrawal time may indicate careful inspection of the colorectal mucosa during screening colonoscopy. Interexaminer differences in the efficiency of endoscopic removal of polyps could indirectly affect the time available for mucosal inspection. However, further prospective study is needed to clarify the specific colonoscopic techniques for mucosal visualization and efficient polypectomy that are important for enhanced detection of neoplasia.

Few reliable benchmarks exist for the inspection component of colonoscopy. Previous authors have suggested allowing 6 to 10 minutes for adequate inspection during colonoscopic withdrawal.[15,16] Our observations support the notion that a minimum adequate amount of time for colonoscopic withdrawal can be equated with the quality of colonoscopy. Furthermore, our results suggest that the rates of detection of neoplasia

Figure 2. Mean Rates of Detection of Adenomas According to Mean Colonoscopic Withdrawal Times for 12 Endoscopists.

The values are for procedures in which no polyps were removed. The significant correlation between rates of detection of adenomas and withdrawal times was calculated with the use of the Spearman rank-correlation coefficient.

may increase further if the period of withdrawal is more than 6 to 10 minutes. Regardless, acceptance of the usefulness of a minimum colonoscopic withdrawal time — whether 6 minutes or longer — would require validation in a prospective study. Variability among observers has been reported with other screening tests for neoplasia, with superior results observed in centers that perform a relatively large number of tests with a relatively high degree of expertise.[18-20]

The goal of screening colonoscopy is to prevent colorectal cancer. The influence that divergent rates of adenoma detection might have on this goal is unclear. On the one hand, detection of diminutive adenomas may have little effect on the risk of colon cancer, since the majority of these lesions do not progress to cancer.[21] Also, persons found to have a single diminutive adenoma are believed to be at no greater risk for the development of colorectal cancer than are those without adenomas.[22]

On the other hand, enhanced detection of adenomas could provide long-term benefits for patients. First, support for the protective effect of colonoscopy against colorectal cancer derives from studies in which all identified adenomatous polyps, regardless of size, were removed.[3,4] Even small polyps can occasionally contain cancer,[23]

a fact underlined in the present study by the discovery of a 7-mm malignant adenoma. Second, our data highlight differences among endoscopists not only in detection of neoplasia overall but also in detection of advanced neoplasia, both of which correlated with colonoscopic withdrawal times. Advanced adenomas are considered important because of their greater propensity for progression to a malignant condition.[24] Third, by definition, tubular adenomas are neoplastic lesions with the potential to progress to cancer. Patients who have adenomatous polyps that were overlooked during a screening colonoscopy may be at risk for progression to cancer, either because of a longer interval between colonic examinations than is appropriate or because of the patient's own decision to forgo colorectal cancer screening in the future. Fourth, the finding of adenomatous polyps may affect the recommendations for colorectal neoplasia screening for relatives of the index patient.[25] Therefore, although these points support the practice of carefully scrutinizing the colorectal mucosa and removing all identified adenomatous polyps during screening colonoscopy, it should be acknowledged that there is a relatively small clinical benefit of detecting and removing very small polyps.

Successful efforts to reduce the disease burden from colorectal cancer depend on implementation of effective screening practices in community settings. Our study showed wide variation in the duration of withdrawal of the colonoscope and higher rates of adenoma detection among endoscopists with longer withdrawal times. However, because of the relatively small number of endoscopists in this study, the generalizability and implications for clinical practice are uncertain and need to be determined by future studies. Furthermore, this study did not address the appropriateness or cost-effectiveness of systematically increasing colonoscopic withdrawal time. Although the findings of this preliminary observational study should be interpreted cautiously, they may inform future efforts to improve strategies for the prevention of colorectal cancer.

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