Published in final edited form as:
J Clin Gastroenterol. 2010 March ; 44(3): e46–e50. doi:10.1097/MCG.0b013e3181a7ed2a.

Findings on Serial Surveillance Colonoscopy in Patients with Low-Risk Polyps on Initial Colonoscopy

Neil Mehta, MD [Resident]
Department of Medicine, Hospital of the University of Pennsylvania, Philadelphia, PA

Jocelyne Miller, MD, MSCE [Fellow]
Department of Medicine, Division of Gastroenterology, Hospital of the University of Pennsylvania

Michael Feldman, MD [Staff Pathologist]
Department of Pathology and Laboratory Medicine, Hospital of the University of Pennsylvania

Emma Furth, MD [Associate Director of Surgical Pathology]
Department of Pathology and Laboratory Medicine, Hospital of the University of Pennsylvania

Gregory G. Ginsberg, MD [Professor of Medicine]
Department of Medicine, Division of Gastroenterology, Hospital of the University of Pennsylvania

Yu-Xiao Yang, MD, MSCE [Assistant Professor of Medicine and Epidemiology]
Department of Medicine, Division of Gastroenterology, Hospital of the University of Pennsylvania

James D. Lewis, MD, MSCE [Associate Professor of Medicine]
Department of Medicine, Division of Gastroenterology, Hospital of the University of Pennsylvania

Abstract

Background—The timing of surveillance colonoscopy in patients with low risk polyps is uncertain.

Goals—This study describes the prevalence of adenomatous polyps at serial follow-up exams after a colonoscopy finding 1-2 small tubular adenomas.

Study—We conducted a retrospective cohort of patients with 1-2 small tubular adenomas on an initial colonoscopy who underwent at least two additional surveillance examinations. Our primary outcome was any or advanced adenomas on the third colonoscopy.

Results—88 patients met inclusion criteria. At the 2nd and 3rd colonoscopy, 31/88 (35.2%) patients and 26/88 (29.6%) patients had at least 1 adenoma, respectively. Among the 28 patients with 1-2 small tubular adenomas on colonoscopy #2, the prevalence of any adenomas on colonoscopy #3 was 39.3% (95% CI 21.5% - 59.4%). Among the 56 patients without adenomas at colonoscopy #2, the prevalence of any and advanced adenomas on colonoscopy #3 was 25% (95% CI 14.4%-38.4%) and 3.6% (95% CI 0.4%-12.3%), respectively.

Conclusion—In patients with 1-2 small tubular adenomas on initial colonoscopy the prevalence of adenomas and advanced lesions on the third colonoscopy remains high even if no adenomas are found on the 2nd colonoscopy.

Corresponding Author: For reprint requests and registration with PubMed Central contact: James Lewis, MD, MSCE lewisjd@mail.med.upenn.edu. For other correspondence contact: Neil Mehta, MD nmehta14@hotmail.com 415-516-8029 Fax # 215-662-7919 Hospital of the University of Pennsylvania, 3400 Spruce St., 100 Centrex, Philadelphia, PA 19104.

Conflict of Interest Statement: There are no potential conflicts of interest that any of the authors have identified relevant to this article.

Introduction

Colorectal cancer is the second leading cause of cancer-related deaths in the United States. 1 Adenomatous polyps are the known precursor for most colorectal cancers. In the US 30-40% of patients over age 50 will have adenomatous polyps on initial screening. 2 These patients are generally recommended for a program of colonoscopic based surveillance.[3-5] According to current guidelines, individuals who have advanced or multiple adenomas (≥3) should have colonoscopy at 3 years and those with 1-2 small tubular adenomas are recommended for repeat at 5-10 years.[3, 5] On a societal level, surveillance creates a large economic burden.6 On a patient level, there is the stress and inconvenience of a procedure that necessitates an involved preparation as well as a small but important risk of procedure related complications.[7, 8]

Screening colonoscopy coupled with post-polypectomy colonoscopic surveillance is an effective way to reduce colon cancer risk, but it is difficult to tease out the benefit derived from initial screening versus ongoing surveillance.[3, 9, 10] Questions remain as to the magnitude of benefit continued surveillance provides especially in patients with low risk polyps. In addition, once patients have had a polypectomy and their follow-up colonoscopy at the defined interval, there are little data to guide clinicians as to what the next step should be. There is some evidence that prior history of polyps changes the rate of polyps in the future but even basic descriptive statistics such as the prevalence of adenomas and high risk adenomas in these follow-up procedures are limited. [11, 12] The goal of this study is to provide descriptive statistics to help define the risk of identifying advanced neoplasia or any neoplasia on follow-up colonoscopies in a patient who has had 1-2 small tubular adenomas removed on colonoscopy.

Materials and Methods

To create the study cohort, we utilized the Olympus Endoworks database to find all patients age 49 or older who had at least 3 colonoscopies each at least 11 months apart within the endoscopy unit for the faculty practice at the Hospital of the University of Pennsylvania and Penn Presbyterian Medical Center. We selected only those patients whose last names fell in the first half of the alphabet (A-M) as the second half was to be used for testing any prediction rules that could be developed.

After the initial database search, we identified 1003 patients and screened them for inclusion into the study. Inclusion required that the first of 3 colonoscopies be a complete colonoscopy to the cecum performed as an outpatient with the identification and removal of 1 or 2 small tubular adenomas without tubulo-villous or villous histology or high grade dysplasia. Small adenomas were those less than 1cm in diameter according to the endoscpist. Although this can be inaccurate, it is the basis of screening recommendations in routine practice and as such was used to define small polyps. For inclusion, the patient was required to have two additional complete colonoscopies with the interval between the 1st and 2nd and between the 2nd and 3rd being at least 11 months. Patients were excluded if they had a history of inflammatory bowel disease, colon cancer or colonic surgery as determined by the endoscopy report or if the initial exam was done for the indication of surveillance for a history of colon polyps or colorectal cancer. Additional exclusions included a poor prep on the initial exam and lack of a pathology or endoscopy report available for review. Finally, patients who had a lost polyp on the first colonoscopy were excluded.

The primary outcome variables were the presence of an advanced adenoma or any adenoma on the third procedure. An advanced adenoma was defined as any adenoma greater than or equal to 1 cm or any adenoma with tubulo-villous or villous histology or high grade dysplasia. As noted, size was determined from the endoscopy report. If this size was not included in the endoscopy report, we utilized the size reported on the pathology report. There were 2 adenomas

that did not have a size documented in the endoscopy or the pathology report. Since the vast majority of adenomatous polyps in our dataset were < 1 cm and it would be unlikely to not report the size of a large polyp since this influences follow-up recommendation, the two adenomas without a size were assumed to be <1cm and were categorized as such for all analyses.

Secondary analysis was done to look at the outcome of any adenoma or advanced adenoma on the second procedure. In addition on the second procedure we grouped patients with 3 or more small tubular adenomas in the outcome as well because it was felt that these patients would be treated the same as advanced adenomas when the gastroenterologists chose the follow-up interval[3].

Data were also collected on other descriptive characteristics. Age, sex and race were obtained from the endoscopy report and health system data. Other information obtained from the endoscopy report included preparation quality (dichotomized into good and excellent vs. fair and poor), the presence of diverticulosis and time interval between procedures (in months).

A few patients had two colonoscopies within 11 months of each other. After the index colonoscopy, if a patient had two colonoscopies within 11 months the results of the two procedures were combined and the latest date was used for analysis.

The study included patients with and without symptoms of colorectal disease. The indication for the colonoscopy was determined from the endoscopy report and grouped into the following categories: family history of colon cancer or polyps, screening/surveillance, anemia/ hematochezia/heme occult blood in stool, other non-colonoscopy screening results (e.g. flexible sigmoidoscopy or barium enema), symptoms/weight loss and other.

Patient with lost polyps on the first procedure were excluded but otherwise lost polyps <1cm were counted as small tubular adenomas and those that were ≥ 1cm were analyzed as advanced adenomas.

Statistical analysis was performed using Stata (version 9.1, Statacorp, College Station, TX). Traditional descriptive statistics were employed including the calculation of prevalence, means and the 95 % confidence intervals. Logistic regression was used to assess for predictors of having at least one adenoma on the third colonoscopy. Univariate logistic regression was performed for the purpose of testing variables to include in multivariate logistic regression. Logistic regression was used to assess for predictors of having at least one adenoma on the third colonoscopy. Variables were included in multivariate regression if they had a p value of ≤ 0.2 or there was strong clinical justification to include them. Variables tested included age (>60), interval between the 1st and 2nd procedure and between the 2nd and 3rd procedure (in months), gender, race (white vs. non-white), the presence of diverticulosis, prep quality (good/ excellent vs. fair/poor) and the presence of adenomas on the second exam. A p value of <0.05 was considered statistically significant.

Results

Of the 1003 patients screened, 88 patients were included. Table 1 details the reasons for exclusion. The majority of patients were excluded because their procedures were done for surveillance or because they had no polyps, >3 adenomas or advanced adenomas on their first procedure. Characteristics of the 88 included patients are listed in Table 2. Ages on the first procedure ranged from 49-85 with a mean age at procedure 1 of 61.2 ± 8.2 years.

In total, 3 colonoscopies were performed on inpatients, 1 was the second procedure and 2 were the 3rd procedure. The majority of patients (88%) had an excellent or good preparation for their

initial colonoscopy (Table 2). On the second procedure 8 patients had a fair preparation and 1 patient had a poor preparation; on the third procedure 16 patients had a fair preparation and 2 patients were listed as having a poor preparation. The procedures included in the study were performed by 36 different physicians. Physicians performed anywhere from 1- 49 procedures within the study. Six attendings performed 71.7% of the procedures included in the study.

Indications for the second and third colonoscopies were listed as surveillance in 90% and 82%, respectively. Many patients had multiple indications listed. The most common indication other than surveillance was anemia, heme positive stool, or hematochezia which was recorded for 11% and 22% of the second and third colonoscopies, respectively. The median time between the 1st and 2nd colonoscopy and between the 2nd and 3rd colonoscopy was 32.6 months (range 11-78 months) and 37.6 months (range 11-102 months), respectively. The mean interval between the second and third colonoscopy was longer for those who had no adenomas on the second procedure (40.6 months) compared to those with 1-2 small adenomas (32.4 months) or an advanced adenoma (30.8 months) on the second procedure (p=0.05)

There were a total of 163 adenomatous polyps removed across all the patients during the three procedures. On the first procedure 73/88 patients had only one adenoma and 15/88 patients had two adenomas removed for a total of 103 adenomatous polyps removed. Table 3 summarizes the findings on the second and third procedures. There were 39 polyps removed on the 2nd procedures and 36 removed on 3rd procedures. There was one lost polyp on the 2nd procedure which was <1cm. There were three patients who had a lost polyps in the 3rd procedure one was < 1cm and analyzed as a small tubular adenoma and two were >1cm (1.4 cm and 2 cm) and were analyzed as advanced adenomas.

At the second and third colonoscopy, 31/88 (35.2%) patients and 26/88 (29.6%) patients had at least one adenoma, respectively. At colonoscopy #2, 4/88 (4.6%) patients had an advanced adenoma or three or more adenomas. At colonoscopy #3, only 3/88 (3.4%) patients (including 2 without histological evaluation) had advanced adenomas (95% CI 0.7-9.6%; time from 2nd to 3rd colonoscopy 39, 48, and 58 months). One of these three patients had 1 advanced adenoma detected on the 2nd colonoscopy, and the other two patients had no adenomas on the 2nd colonoscopy. An additional two patients had three or more adenomas on the 3rd colonoscopy.

Among the 56 patients without adenomatous polyps at colonoscopy #2 (Table 3), the prevalence of any and advanced adenomas on colonoscopy #3 was 25% (95% CI 14.4%-38.4%) and 3.6% (95% CI 4.4%-12.3%), respectively. Among the 28 patients with 1-2 small tubular adenomas on colonoscopy #2 (Table 3), the prevalence of any adenomas on colonoscopy #3 was 39.3% (95% CI 21.5%- 59.4%) and none of these patients had an advanced adenoma on procedure #3. Only 4 patients had advanced adenomas at colonoscopy #2, of whom 3 had adenomas at colonoscopy #3 (Table 3). Among the 84 patients without an advanced adenoma or three or more adenomas at colonoscopy #2, the prevalence of any and advanced adenomas on colonoscopy #3 was 29.8% (95% CI 20.1%-40.7%) and 2.4% (95% CI 0.3%-8.3%), respectively.

When we tested for variables associated with the presence of adenomas on the third colonoscopy, the only variables that had a p value of <0.2 were gender (p=0.16) and the presence of adenomas on the second procedure (p=0.11). Although the interval between the 2nd and 3rd procedure did not have a p value <0.2 in our univariate analysis we were concerned about it being a confounder given the trend towards a shorter interval in those with polyps and advanced adenomas and included it in our multivariate analysis. None of the variables were significantly associated with the prevalence of adenomas on the third exam in the multivariable analysis however there was a suggestion of a positive association with the presence of an adenoma on the second colonoscopy with an odds ratio of 2.2 (95% CI 0.8 - 6.0, p=.12).

Discussion

The purpose of performing screening colonoscopies is to find early stage colon cancer and to prevent colon cancer by performing polypectomy. What remains unclear is how beneficial it is to continue surveillance after initial screening. Our study confirms that there continues to be a high percentage of patients who have adenomatous polyps on follow-up colonoscopies even after two low risk exams. In fact, after having two low risk colonoscopies (i.e. two or fewer small tubular adenomas), 30% of patients were found to have adenomatous polyps within approximately 3 years after their most recent colonoscopy, and 2.4% had advanced adenomas. Interestingly, these results are nearly identical to a recently published study by Pinsky et al. where 30% of patients had any adenoma and 4% had advanced adenomas on follow-up colonoscopy after two low risk exams.[12] By looking at 3 procedures as opposed to only 2, these studies provide insight into anticipated outcomes as patients continue in long-term surveillance and how utilizing the results of several previous procedures rather than just the most recent colonoscopy may help better define surveillance intervals.

We had a relatively long average follow-up time from the first to second and second to third colonoscopy, with the average interval for both exams being approximately 3 years. While this is somewhat shorter than the currently recommended interval after removing 1-2 small polyps of 5 years, it was common during the time interval of the study and it is comparable to other studies whose follow-up was also 3 years or even less.[12-14] Of note, in this study and the recent study by Pinsky,[12] surveillance interval was not associated with the prevalence of adenoma at repeat endoscopy.

The polyps observed on the serial colonoscopies likely included both new polyps that developed since the prior colonoscopy and polyps missed at the prior procedure. Importantly, for developing surveillance guidelines, knowledge of the prevalence of the polyps is more important than knowledge of the origin of the polyps. Of course, as colonoscopy techniques improve and reduce the prevalence of missed polyps, similar studies will need to be repeated.

The major weakness in this study is the relative small sample size, which was driven by our inclusion criteria to have had one or two small tubular adenomas on the first colonoscopy and to have completed two subsequent surveillance exams. The relatively small sample size limited our ability to conduct multivariable prediction models, and for this reason, this study primarily provides descriptive statistics.

A potential limitation is that only patients who had 3 colonoscopies were included. This may bias towards patients who are more likely to have polyps. However, the results on the initial follow-up colonoscopy (#2) in our study were comparable to other studies that looked at a similar outcome.[11, 13-15] Since the prevalence of any and advanced adenomas on the second exam in our study were comparable to these other studies, “over-selection” of high risk patients seems unlikely. Therefore, the prevalence of any and advanced adenomas observed on the third exam are unlikely to be significantly biased by our inclusion criteria.

Another limitation is the fact that two of the three advanced adenomas were actually lost polyps. These two polyps were classified as advanced adenomas because of their size. Given the extra steps involved in retrieving large polyps on colonoscopy it would certainly be biased to not include these lost polyps in the analysis[16].

Screening and surveillance guideline have primarily focused on the first and second examination. Whether the timing of subsequent examinations should depend on only the findings at the most recent exam or on the entire screening history is unclear. After an initial colonoscopy with 1 or 2 small tubular adenomas 36% of patients in this study had at least one adenoma on the second colonoscopy which is similar to the 40% prevalence of any adenoma

after a second colonoscopy with one or two small tubular adenomas. This suggests that having a few small tubular adenomas on multiple exams does not dramatically change one's risk of having adenomas on future exams, and as such does not suggest a need to shorten surveillance intervals in patients with a history of small adenomatous polyps on several prior exams. However, although patients in our study were somewhat more likely to have an adenoma on their third exam if they had one on their second exam, even among those patients without any adenomas on the second exam, there was still a 25% chance of having an adenoma on the third exam performed approximately 3 years later, and 2 of 52 patients had an advanced polyp. Although we cannot project how quickly these polyps might progress to cancer, such a high prevalence of adenomatous polyps signals the need for caution in recommending very long surveillance intervals for patients with a history of adenomatous polyps who have a subsequent surveillance colonoscopy without additional polyps identified. Of course, defining an optimal surveillance interval for different clinical scenarios must also include consideration of cost-effectiveness. As such, incorporation of data from this study and similar future studies into cost-effectiveness models will be extremely important to further refine colorectal cancer surveillance guidelines. Likewise, as new technologies allow us to identify more patients with these small polyps it is critical to better define surveillance strategies to allow for the most effective and cost-effective approach to preventing colorectal cancer[17, 18].

Acknowledgments

Declaration of Funding Source: This work was supported in part by NIH grants T32DK007740 and K24-DK078228.

References

1. Jemal A, Murray T, Ward E, et al. Cancer Statistics, 2005. CA: a Cancer Journal for Clinicians 2005;55:10–30. [PubMed: 15661684]
2. Lieberman D, Weiss D, Bond J, et al. Use of colonoscopy to screen asymptomatic adults for colorectal cancer. N Eng J Med 2000;343:162–168.
3. Winawer S, Fletcher R, Rex D, et al. Colorectal cancer screening and surveillance: clinical guidelines and rationale-Update based on new evidence. Gastroenterology 2003;124:544–60. [PubMed: 12557158]
4. Davila R, Rajan E, Baron T, et al. ASGE guideline: colorectal cancer screening and surveillance. Gastrointestinal Endoscopy 2006;63:546–557. [PubMed: 16564851]
5. Winawer SJ, Zauber AG, Fletcher RH, et al. Guidelines for colonoscopy surveillance after polypectomy: a consensus update by the US Multi-Society Task Force on Colorectal Cancer and the American Cancer Society. Gastroenterology 2006;130:1872–85. [PubMed: 16697750]
6. Ladabaum U, Song K. Projected national impact of colorectal cancer screening on clinical and economic outcomes and health services demand. Gastroenterology 2005;129:1151–62. [PubMed: 16230069]
7. Nelson DB, McQuaid KR, Bond JH, et al. Procedural success and complications of large-scale screening colonoscopy. Gastroentest Endosc 2002;55:307–314.
8. Rathgaber S, Wick T. Colonoscopy completion and complication rates in a community gastroenterology practice. Gastrointest Endosc 2006;64:556–562. [PubMed: 16996349]
9. Winawer S, Zauber A, Ho N, et al. Prevention of colorectal cancer by polypectomy. N Eng J Med 1993;329:1977–1981.
10. Citarda F, Tomaselli G, Capocaccia R, et al. Efficacy in standard clinical practice of colonoscopic polypectomy in reducing colorectal cancer incidence. Gut 2001;48:812–5. [PubMed: 11358901]
11. Bonithon-Kopp C, Piard F, Fenger C, et al. Colorectal adenoma characteristics as predictors of recurrence. Dis Colon Rectum 2004;47:323–33. [PubMed: 14991494]
12. Pinsky PF, Schoen RE, Weissfeld JL, et al. The yield of surveillance colonoscopy by adenoma history and time to examination. Clin Gastroenterol Hepatol 2009;7:86–92. [PubMed: 18829395]

13. Martinez ME, Sampliner R, Marshall JR, et al. Adenoma characteristics as risk factors for recurrence of advanced adenomas. Gastroenterology 2001;120:1077–83. [PubMed: 11266371]

14. Noshirwani KC, van Stolk RU, Rybicki LA, et al. Adenoma size and number are predictive of adenoma recurrence: implications for surveillance colonoscopy. Gastrointest Endosc 2000;51:433–7. [PubMed: 10744815]

15. Saini S, Kim H, Schoenfeld P. Incidence of advanced adenomas at surveillance colonoscopy in patients with a personal history of colon adenomas: a metaanalysis and systematic review. Gastrointest Endosc 2006;64:614–626. [PubMed: 16996358]

16. Pickhardt PJ, Choi JR, Hwang I, et al. Nonadenomatous Polyps at CT Colonography: Prevalence, Size Distribution, and Detection Rates. Radiology 2004;232:784–90. [PubMed: 15247435]

17. Rex DK, Helbig CC. High Yields of Small and Flat Adenomas With High-Definition Colonoscopes Using Either White Light or Narrow Band Imaging. Gastroenterology 2007;133:42–47. [PubMed: 17631129]

18. Barclay RL, Vicari JJ, Doughty AS, et al. Colonoscopic Withdrawal Times and Adenoma Detection during Screening Colonoscopy. N Eng J Med 2006;355:2533–41.

Table 1

Reason for Exclusion

Reason for Exclusion	Number
No adenoma on first colonoscopy	231
History of Polyps	229
Advanced adenomas on first colonoscopy	130
History of Colon Cancer	116
>2 adenomas on first colonoscopy	42
Adenocarcinoma on first colonoscopy	42
No endoscopy report	34
Database error (duplicates or test patients)	20
Poor prep	18
Incomplete exam	18
History of prior colon surgery	12
Colitis	10
No path report	9
Lost polyp on first colonoscopy	3
Polyp could not be removed	1
Total Excluded	915
Total Included	88
Total Screened	1003

Table 2

Basic demographic information

		Number (n=88)	Percent
Gender			
	Male	52	59.1
	Female	36	41.0
Race			
	White	58	65.9
	Black	26	29.6
	Other	2	2.3
	Unknown	2	2.3
Age			
	Age ≤60	49	55.7
	Age>60	39	44.3
Bowel preparation for 1st colonoscopy			
	Excellent or good	77	87.5
	Adequate	3	3.4
	Fair	7	8.0
	Unknown	1	1.1
Indication for 1st colonoscopy*			
	Average risk screening	7	8.0
	Anemia, heme+ stool, bleeding	34	38.6
	Other non-colonoscopy screening results	19	21.6
	Weight loss, change in bowel habits, abdominal pain	21	23.9
	Family history of colonic neoplasia	20	22.7
	Other	4	4.6

* Patients could have more than one indication listed

Table 3

Findings on the second and third surveillance colonoscopy

Procedure 2 Finding	Procedure 3 Finding	Number (%)
No adenoma		**56**
	No adenoma	42 (75)
	Small tubular adenoma	12 (21)
	Advanced adenoma	2 (4)*
1 or 2 small tubular adenoma**		**27**
	No adenoma	16 (59)
	Small tubular adenoma	11 (41)
	Advanced adenoma	0 (0)
Advanced adenoma or 3 or more small tubular adenomas		**4**
	No adenoma	2 (50)
	Small tubular adenoma	1 (25)
	Advanced adenoma	1 (25)***
1 lost polyp (<1cm)		**1**
	No adenoma	1 (100)

* Includes a 20mm sessile polyp that was not recovered.

** Includes a 3mm polyp that was not recovered.

*** Includes a 14mm pedunculated polyp that was not recovered.

Table 4

Results of the univariate and multivariate analysis to assess relationship to the presence of adenomas on the third colonoscopy*.

Variable	Univariate Analysis Odds Ratio (95% CI)	Multivariate Analysis Odds Ratio (95% CI)
Age (>60)	0.65 (0.26, 1.64)	
Race (White vs. Non-white)	1.33 (0.50, 3.56)	
Presence of diverticulosis	0.75 (0.28, 1.98)	
Preparation on the 2nd exam (Fair/Poor vs. Good/ Excellent)	0.63 (0.12, 3.27)	
Interval between the 2nd and 3rd procedure (≥3 yrs)	0.84 (0.34, 2.08)	0.95 (0.37, 2.49)
Gender (Female vs. Male)	0.50 (0.19, 1.31)	0.53 (0.20, 1.43)
Presence of adenomas on 2nd exam	2.17 (0.85, 5.52)	2.08 (0.79, 5.50)

*The final multivariate analysis included interval between the 2nd and 3rd procedures, gender and the presence of adenomas on the 2nd exam.