MAYO CLINIC

Recommended Intervals Between Screening and Surveillance Colonoscopies

Todd H. Baron, MD; Thomas C. Smyrk, MD; and Douglas K. Rex, MD

Abstract

Colonoscopy has become the mainstay for screening and surveillance of colorectal cancer. The guidelines for screening and surveillance colonoscopy have recently been updated, particularly in light of greater recognition of the importance of sessile serrated lesions in the role of cancer. It is important for practitioners to be aware of and understand the recommendations for screening and surveillance to optimize patient safety and to decrease health care use. We searched PubMed for articles and guidelines related to screening and surveillance of colonic polyps and serrated adenomas. The related citations feature was also used. The search was conducted from February 22, 2013, to March 2, 2013, and we included the search terms *colorectal cancer screening, colonoscopy, guidelines, colorectal polyps,* and *colorectal surveillance*. We selected the most recent guidelines and pertinent articles for this review, in which we discuss the basis of screening and surveillance colonoscopy and provide recommendations for colonoscopy intervals.

 ■ Mayo Clin Proc. 2013;88(8):854-858

From the Division of Gastroenterology and Hepatology (T.H.B.) and Division of Surgical Pathology (T.C.S.), Mayo Clinic, Rochester, MN; and Division of Gastroenterology, Indiana University, Indianapolis (D.K.R.).

Colonoscopy has become the most widely accepted method of screening for colon cancer in the United States. Colonoscopic screening reduces the mortality of colorectal cancer through early identification of cancer[1] and reduction of the incidence of cancer by identification and removal of precancerous lesions.[1-4] Findings of colonoscopy in patients without colon cancer allow stratification of subsequent risk of colorectal cancer. This in turn determines the timing of subsequent colonoscopic examinations. Because of the already frequent use of medical resources, the costs of providing surveillance colonoscopy, and the inherent procedural risks, it is vital that clinicians are aware of the recommendations for intervals between colonoscopies, especially in light of updated guidelines and recent recommendations.[5-7] In this article, we review the guidelines on surveillance colonoscopy. We do not discuss patients with invasive colorectal carcinoma, polyposis syndromes, or inflammatory bowel disease.

We searched PubMed for articles and guidelines related to screening and surveillance of colonic polyps and serrated adenomas. The related citations feature was also used. The search was conducted from February 22, 2013, to March 2, 2013, and we included the search terms *colorectal cancer screening, colonoscopy, guidelines, colorectal polyps,* and *colorectal surveillance*. We included the most recent guidelines and pertinent articles for this review.

DEFINITIONS

The following definitions are useful for understanding surveillance colonoscopy guidelines.

Screening colonoscopy refers to a colonoscopy for colorectal cancer and precancerous lesions in an individual with no personal history of cancer or precancerous lesions and who has no signs and symptoms of suspected colorectal disease (bleeding, abdominal pain, or altered bowl habits). Guidelines for screening colonoscopy can be found elsewhere,[5,6] but for individuals at average risk, screening colonoscopy is recommended beginning at 50 years of age and should be repeated at 10-year intervals if the results are negative. The same recommendations apply to persons with only one first-degree relative diagnosed as having colorectal cancer after 60 years of age, although some recommendations suggest beginning at 40 years of age in this population.[8] If there are 2 first-degree relatives with colorectal cancer or 1 diagnosed as having colorectal cancer at younger than 60 years, colonoscopy should be performed at 5-year intervals beginning at 40 years of age or 10 years before the age at which a relative was diagnosed as having cancer.

Mayo Clin Proc. ■ August 2013;88(8):854-858 ■ http://dx.doi.org/10.1016/j.mayocp.2013.04.023
www.mayoclinicproceedings.org ■

Surveillance colonoscopy is any colonoscopic examination performed to identify recurrent or metachronous neoplasia in an asymptomatic individual with previously identified precancerous lesions (the term *surveillance* is also applied to patients with previous cancer but that group is not covered here).

Interval cancer is colorectal cancer that develops in the interval between an initial colonoscopy that either produced a negative result or was purported to clear the colon of neoplasia and the next planned examination. It is believed that most of these cancers are due to missed lesions at the baseline colonoscopy.[5]

A *polyp* is any raised lesion visible at endoscopy. (For purposes of this review, flat and depressed lesions will also be included under the umbrella term *polyp*.) Polyps can be classified by cell lineage (epithelial, mesenchymal, or hematolymphoid) or by site of origin (mucosa, submucosa, or muscularis propria). We focus on the epithelial mucosal polyps most commonly encountered in practice (ie, adenomatous and serrated polyps) (Table 1).

Terms and histologic criteria for colon polyps are provided by the World Health Organization.[9] Briefly, adenomas are neoplastic collections of dysplastic crypts. The dysplasia can be low grade (dark, elongated nuclei with pseudostratification but no considerable pleomorphism) or high grade (complex glands lined by disorganized, pleomorphis nuclei). Adenomas are subdivided according to the extent of villous architecture on the polyp surface, with the designations *tubular*, *tubulovillous,* and *villous* corresponding to less than one-third, one-third to two-thirds, or more than two-thirds villous architecture. Adenomas appear to be precursor lesions for 70% of colorectal cancers.

Advanced adenomas are defined as adenomas 1 cm or larger or those with villous components (tubulovillous or villous) or high-grade dysplasia. Patients with such lesions have a significantly increased risk for subsequent development of advanced lesions in the colon.[5] Patients with advanced adenomas and those with 3 or more adenomas are considered to have high-risk adenoma findings and should undergo additional colonoscopy in 3 years. If no new lesions are found, these patients should continue to undergo colonoscopy at 5-year intervals. Patients who have only 1 or 2 tubular adenomas with low-grade dysplasia smaller than 1 cm are considered a low-risk group for subsequent *advanced adenomas*. This low-risk group can undergo their next colonoscopy at 5 to 10 years. If that colonoscopy result is negative, this group should return to the average-risk screening pool (ie, colonoscopy at 10-year intervals).

Serrated polyps are characterized by a saw-toothed or serrated crypt contour. In *hyperplastic polyps*, the serrations are limited to the upper portion of the crypt. The hallmarks of the sessile serrated adenoma/polyp (SSA/P) are serrations extending the crypt base, accompanied by lateral branching of the crypt. By definition, the SSA/P does not have cytologic dysplasia (thus the controversy over whether

ARTICLE HIGHLIGHTS

- Screening colonoscopy reduces the incidence and mortality of colorectal cancer.
- Findings at screening colonoscopy stratify risk for the development of colorectal cancer and intervals for subsequent examination.
- Sessile serrated adenomas are endoscopically subtle lesions and now recognized as contributing to colorectal cancer in up to 30% of cases.
- Intervals for screening and surveillance colonoscopy are based on the assumption of clearance of polyps, type and number of polyps, and adequacy of bowel preparation.
- Colonoscopist adherence to recommended intervals of screening and surveillance colonoscopy is variable.

TABLE 1. Epithelial Mucosal Polyps[a]

Polyp type	Premalignant	Syndromes
Adenoma	Yes[b]	FAP, Lynch syndrome,[c] *MUTYH* polyposis[d]
Tubular adenoma		
Tubulovillous adenoma		
Villous adenoma		
Serrated		
Hyperplastic	No[e]	None
SSA/P	Yes	Serrated polyposis, *MUTYH* polyposis
SSA/P with dysplasia	Yes	None
Traditional serrated adenoma	Yes	Unknown

[a]FAP = familial adenomatous polyposis; SSA/P = sessile serrated adenoma/polyp.
[b]"Yes" applies to all Adenoma subcategories.
[c]Lynch syndrome is not a polyposis, but adenoma is the precursor lesion.
[d]*MUTYH* polyposis is an autosomal recessive form of familial adenomatous polyposis.
[e]Patients with serrated polyposis often have hyperplastic polyps as part of the mix.

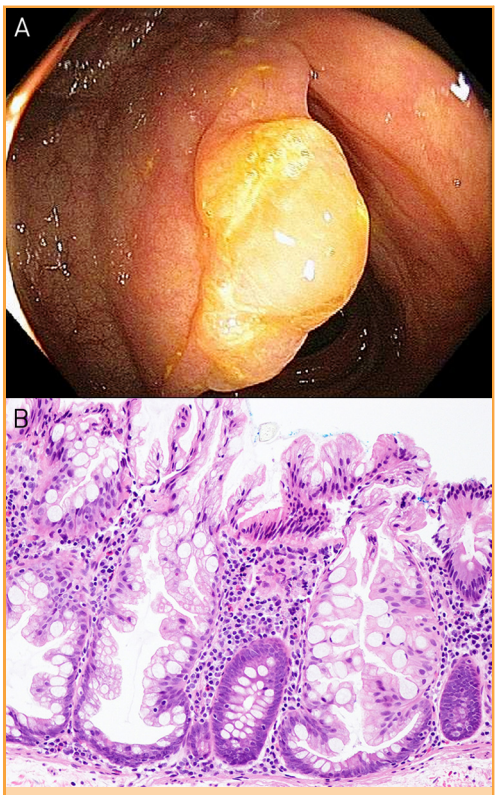

FIGURE. A sessile serrated adenoma. A, Endoscopic appearance of a sessile serrated adenoma. Note the subtle change in mucosa and elevation and the characteristic overlying mucous cap. The debris is the brighter yellow material that clustered at different points around the edge of the lesion. B, Histologic appearance of classic sessile serrated adenoma. Serrations extending to the base of the crypt with lateral branching at the crypt base. There is no cytologic dysplasia.

to call it SSA or SSP), but dysplasia can develop in SSA/P, and its presence should be documented by the pathologist. The serrated pathway is thought to account for 30% of colorectal cancer, and SSA/Ps larger than 1 cm or with dysplasia are considered to be advanced lesions.[7,10,11] Approximately 80% of SSA/Ps are located proximal to the sigmoid colon.[7]

TABLE 2. Diagnostic Criteria for Serrated Polyposis

At least 5 serrated polyps proximal to the sigmoid colon, with 2 or more being >10 mm
OR
Any number of serrated polyps proximal to the sigmoid colon in an individual who has a first-degree relative with serrated polyposis
OR
>20 Serrated polyps of any size, distributed throughout the colon

Data from *WHO Classification of Tumors of the Digestive System*.[14]

These lesions are often endoscopically subtle (Figure) but are being increasingly identified endoscopically because of heightened awareness and improved optics. However, interval cancers have higher rates of microsatellite instability, hypermethylation, and BRAF sequence variations, molecular features that are shared with SSA/P.[7] Thus, failed detection of an SSA/P during colonoscopy is an important clinical problem. Specific training in the endoscopic appearances of subtle lesions and in optimal colonoscopic examination technique can improve detection by a colonoscopist.[12] Traditional serrated adenoma accounts for 1% to 2% of epithelial polyps. Traditional serrated adenoma is classified as a serrated polyp by virtue of its serrated architecture, but it is not clear whether it is part of the serrated pathway. Traditional serrated adenoma contains dysplasia, often of a very low-grade variety.[13]

Serrated polyps are often multiple. At this point, the dividing line between multiple sporadic SSA/Ps and a polyposis syndrome is purely descriptive. Table 2 shows the current diagnostic criteria for serrated polyposis according to the World Health Organization.[14] As the World Health Organization fascicle notes, the criteria are "empirical and the described categories may represent different diseases." As currently defined, serrated polyposis is associated with a high risk of synchronous and metachronous colorectal cancers.[15]

ROLE OF BOWEL PREPARATION

Guidelines and recommendations for surveillance assume that the bowel preparation allowed visualization of the colonic mucosa. Inadequate bowel preparation can result in missed polyps[16,17] and cancers and the development of interval cancer.[18] Thus, in patients with an inadequate bowel preparation, subsequent examination is recommended. The exact timing of the subsequent colonoscopy is not well defined, but in general, patients with inadequate bowel preparation should have a subsequent examination either at the next available appointment or within 1 year.

RECOMMENDATIONS FOR SURVEILLANCE COLONOSCOPY

Recommendations for additional screening colonoscopy in patients with a normal colonoscopy result and for surveillance colonoscopy

Mayo Clin Proc. ■ August 2013;88(8):854-858 ■ http://dx.doi.org/10.1016/j.mayocp.2013.04.023
www.mayoclinicproceedings.org

TABLE 3. Recommendations for Colonoscopy Based on the Presence or Absence of Adenomatous Polyps

Baseline colonoscopy: most advanced finding(s)	Recommended surveillance interval (y)
No polyps	10
Small (<10 mm) hyperplastic polyps in rectum or sigmoid	10
1-2 Small (<10 mm) tubular adenomas	5-10
3-10 Tubular adenomas	3
>10 Adenomas	<3
Any adenoma ≥10 mm	3
Any adenoma with villous elements (villous or tubulovillous) or with high-grade dysplasia	3

Adapted from *Gastroenterology*,[5] with permission.

TABLE 4. Recommendations for Colonoscopy Based on the Presence of Serrated Polyps

Baseline colonoscopy: most advanced finding(s)	Recommended surveillance interval (y)
Sessile serrated adenoma/polyp(s) <10 mm with no dysplasia	5
Sessile serrated adenoma/polyp(s) ≥10 mm	3
Sessile serrated adenoma/polyp with dysplasia	3
Traditional serrated adenoma	3
Serrated polyposis syndrome (see text)	1

Adapted from *Gastroenterology*,[5] with permission.

in those with adenomatous polyps are listed in Table 3. These recommendations assume that the baseline colonoscopy was complete (the cecum was reached), the bowel preparation was adequate, and all endoscopically identified polyps were completely removed. Recommendations for surveillance colonoscopy for SSA/Ps from the US Multi-Society Task Force on Colorectal Cancer are listed in Table 4.[5] Surveillance recommendations after SSA/P resection have been made on the basis of limited data. The recommendations largely reflect expert consensus evaluating evidence that the SSA/P histologic type (vs hyperplastic histologic type), large size, increasing number, proximal location, and the presence of cytologic dysplasia in SSA/Ps are each associated with synchronous and to some extent metachronous colorectal cancer.[7] An alternative set of recommendations (not shown) is similar to those in Table 4 but adds recommendations that account for increasing number and proximal location of serrated lesions (both SSA/P and hyperplastic histologic type).[7]

SURVEILLANCE COLONOSCOPY IN ELDERLY PATIENTS

It is unknown at what age surveillance colonoscopy can be safely discontinued in elderly patients.[19] Factors to be considered include the findings of recent colonoscopies and the patient's life expectancy on the basis of age and comorbidities. When life expectancy is less than 10 years, cessation of surveillance should be considered, particularly in patients deemed at low risk of developing colorectal cancer.

ADHERENCE TO SURVEILLANCE COLONOSCOPY RECOMMENDATIONS BY COLONOSCOPISTS

Adherence to colonoscopic guidelines is not uniform, even among gastroenterologists.[20] Overuse and underuse of colonoscopy seem to be common.[5,21] Nonadherence may occur even among gastroenterologists with an understanding of guideline recommendations. However, this appears to be a less common cause than lack of knowledge of guideline recommendations for polyp surveillance. Because referral for colonoscopy is often from general practitioners and other nongastroenterologists, one can imagine that nonadherence to recommendations is a large problem, particularly in open-access endoscopy systems. Triage systems within open-access endoscopy centers can decrease overuse.[22]

Abbreviations and Acronyms: **FAP** = familial adenomatous polyposis; **SSA/P** = sessile serrated adenoma/polyp

Correspondence: Address to Todd H. Baron, MD, Division of Gastroenterology and Hepatology, Mayo Clinic, 200 First St SW, Rochester, MN 55905 (baron.todd@mayo.edu).

REFERENCES

1. Lieberman D. Colorectal cancer screening: practice guidelines. *Dig Dis*. 2012;30(suppl 2):34-38.
2. Zauber AG, Winawer SJ, O'Brien MJ, et al. Colonoscopic polypectomy and long-term prevention of colorectal-cancer deaths. *N Engl J Med*. 2012;366(8):687-696.
3. Manser CN, Bachmann LM, Brunner J, Hunold F, Bauerfeind P, Marbet UA. Colonoscopy screening markedly reduces the occurrence of colon carcinomas and carcinoma-related death: a closed-cohort study. *Gastrointest Endosc*. 2012;76(1):110-117.

4. Ausk KJ, Dominitz JA. Colonoscopy prevents colorectal cancer in both the right and left colon. *Gastroenterology*. 2011;141(1):393-396.
5. Lieberman DA, Rex DK, Winawer SJ, Giardiello FM, Johnson DA, Levin TR; United States Multi-Society Task Force on Colorectal Cancer. Guidelines for colonoscopy surveillance after screening and polypectomy: a consensus update by the US Multi-Society Task Force on Colorectal Cancer. *Gastroenterology*. 2012;143(3):844-857.
6. Rex DK, Ahnen DJ, Baron JA, et al. Serrated lesions of the colorectum: review and recommendations from an expert panel. *Am J Gastroenterol*. 2012;107(9):1315-1330.
7. Kahi CJ, Anderson JC, Rex DK. Screening and surveillance for colorectal cancer: state of the art. *Gastrointest Endosc*. 2013;77(3):335-350.
8. Levin B, Lieberman DA, McFarland B, et al; American Cancer Society Colorectal Cancer Advisory Group; US Multi-Society Task Force; American College of Radiology Colon Cancer Committee. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society, the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. *Gastroenterology*. 2008;134(5):1570-1595.
9. Hamilton SR, Aaltonen LA. Pathology and Genetics of Tumors of the Digestive Tract. Lyon, France: IARC Press; 2000. http://w2.iarc.fr/en/publications/pdfs-online/pat-gen/bb2/BB2.pdf. Accessed February 23, 2013.
10. Burnett-Hartman AN, Newcomb PA, Phipps AI, et al. Colorectal endoscopy, advanced adenomas, and sessile serrated polyps: implications for proximal colon cancer. *Am J Gastroenterol*. 2012;107(8):1213-1219.
11. Vemulapalli KC, Rex DK. Failure to recognize serrated polyposis syndrome in a cohort with large sessile colorectal polyps. *Gastrointest Endosc*. 2012;75(6):1206-1210.
12. Coe SG, Crook JE, Diehl NN, Wallace MB. An endoscopic quality improvement program improves detection of colorectal adenomas. *Am J Gastroenterol*. 2013;108(2):219-227.
13. Sweetser S, Smyrk TC, Sinicrope FA. Serrated colon polyps as precursors to colorectal cancer. *Clin Gastroenterol Hepatol*. 2013;11(7):760-767.
14. Snover DC, Ahnen DJ, Burt RW, Odze RD. Serrated polyps of the colon and rectum and serrated polyposis. In: Bosman FT, Carneiro F, Hruban RH, Theise ND, eds. *WHO Classification of Tumors of the Digestive System*. 4th ed. Lyon, France: IARC; 2010:160-165.
15. Edelstein DL, Axilbund JE, Hylind LM, et al. Serrated polyposis: rapid and relentless development of colorectal neoplasia. *Gut*. 2013;62(3):404-408.
16. Hong SN, Sung IK, Kim JH, et al. The effect of the bowel preparation status on the risk of missing polyp and adenoma during screening colonoscopy: a tandem colonoscopic study. *Clin Endosc*. 2012;45(4):404-411.
17. Chokshi RV, Hovis CE, Hollander T, Early DS, Wang JS. Prevalence of missed adenomas in patients with inadequate bowel preparation on screening colonoscopy. *Gastrointest Endosc*. 2012;75(6):1197-1203.
18. Sanduleanu S, Masclee AM, Meijer GA. Interval cancers after colonoscopy—insights and recommendations. *Nat Rev Gastroenterol Hepatol*. 2012;9(9):550-554.
19. Day LW, Walter LC, Velayos F. Colorectal cancer screening and surveillance in the elderly patient. *Am J Gastroenterol*. 2011;106(7):1197-1127.
20. Shah TU, Voils CI, McNeil R, Wu R, Fisher DA. Understanding gastroenterologist adherence to polyp surveillance guidelines. *Am J Gastroenterol*. 2012;107(9):1283-1287.
21. Schoen RE, Pinsky PF, Weissfeld JL, et al. Utilization of surveillance colonoscopy in community practice. *Gastroenterology*. 2010;138(1):73-81.
22. Baron TH, Kimery BD, Sorbi D, Gorkis LC, Leighton JA, Fleischer DE. Strategies to address increased demand for colonoscopy: guidelines in an open endoscopy practice. *Clin Gastroenterol Hepatol*. 2004;2(2):178-182.