Screening for Colon Cancer in Older Adults: Risks, Benefits, and When to Stop

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Learning Objectives: On completion of this article, you should be able to (1) recognize the risk of colorectal cancer in the elderly, (2) determine when to stop screening for colorectal cancer in the elderly, and (3) explain the difference in the risks and benefits of the available colorectal cancer screening modalities.

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Abstract

Colorectal cancer (CRC) is the fourth leading cause of cancer and second leading cause of mortality from cancer in the United States. As the population ages, decisions regarding the initiation and cessation of screening and surveillance for CRC are of increasing importance. In elderly patients, the risks of CRC and the presenting signs and symptoms are similar to those in younger patients. Screening and ongoing surveillance should be considered in patients who have a life expectancy of 10 years or more. Life expectancy estimates can be calculated using online calculators. If screening is deemed appropriate, the choice of which test to use first is unclear. Currently, there are a number of modalities available to screen for CRC, including both invasive modalities (eg, colonoscopy, sigmoidoscopy, capsule colonoscopy, and computed tomographic colonography) and noninvasive modalities (fecal immunochemical test, stool DNA testing, and blood testing). Colonoscopy and other invasive testing options are considered safe, but the risks of complications of the bowel preparation, the procedure, and sedation medications are all increased in older patients. In contrast, noninvasive testing provides a safe initial test; however, it is important to consider the increased false-positive rates in the elderly, and a positive test result will usually necessitate

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colonoscopy to establish the diagnosis. Ongoing screening and surveillance should be a shared decision-making process with the patient based on multiple factors including the patient's morbidity and mortality risk from CRC and his or her underlying comorbidities, the patient's functional status, and the patient's preferences for screening. Ultimately, the decision to initiate or discontinue screening for CRC in older patients should be done based on a case-by-case individualized discussion.

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Colorectal cancer (CRC) is the fourth leading cause of cancer and second leading cause of mortality from cancer in the United States. Forty-two percent of new diagnoses of CRC are in patients 65 years and older. The risk is even higher in women, with 27% of cases diagnosed at the age of 80 years and above, with 40% of deaths occurring in this age group.[1] Although age is not a modifiable risk factor for developing CRC, the benefits of screening for CRC in older adults is less clear. In general, colon cancer screening is used as a means to identify adenomatous polyps and remove them before the development of cancer and has thus far been considered the criterion standard in CRC screening. Currently, there are multiple modalities to screen for CRC, including noninvasive modalities (stool-based testing, radiologic testing, and blood testing) and invasive modalities (endoscopic screening including colonoscopy or sigmoidoscopy). However, all these procedures are not without risk. Recent guidelines from the US Preventive Services Task Force recommend against screening individuals older than 85 years for CRC and noted uncertainty in the benefits of screening patients between the ages of 76 and 85 years.[2] However, the overall benefit of screening and surveillance is actually rooted in the patient's life expectancy combined with the risk of morbidity and mortality from developing a malignant neoplasm. As a result, though new screening for CRC may not be appropriate at the population level, select individuals may still benefit from screening regardless of their age. This review summarizes the current literature on screening for CRC in older adults. *Older adults* are defined as those 65 years and older.

EPIDEMIOLOGY

Colorectal cancer incidence and mortality have decreased dramatically in the past decade, secondary to increased CRC screening and surveillance. In 2017, it was projected that 135,430 individuals would be newly diagnosed with CRC and 40,260 deaths would occur from the disease. However, trends in CRC incidence vary by age, with 90% of new CRC diagnoses in those older than 50 years[1] (Figures 1 and 2).

In older adults, CRC incidence rates have dropped precipitously from 298.3 per 100,000 to 186.8 per 100,000 from 2000 to 2013. This reduction in both incidence of and mortality from CRC is most likely due to nationwide screening and surveillance programs for CRC. Despite this decline, in 2017, 42% of new cases of CRC occurred in people 65 years and older. Compared with individuals aged between 50 and 64 years with an average decrease in incidence of CRC by 1.4% per year, older adult individuals have reported an average decrease in the incidence of CRC by 4% per year. Unlike in those individuals younger than 50 years, this has been shown irrespective of tumor location, stage, or race/ethnicity in older adults.[1]

SIGNS AND SYMPTOMS

Colorectal cancer can present with varying symptoms depending on the site of cancer in the colon or rectum. Symptoms are most often changes in stool caliber, followed by gastrointestinal bleeding, abdominal pain, and constipation in patients aged 65 to 79 years. Symptoms are slightly different in those 80 years and older. Weight loss is more common in this age group, and presenting symptoms are predominantly changes in stool caliber followed by abdominal pain and gastrointestinal bleeding.

Infrequently, patients present with abdominal obstruction.[3-5]

RISK OF NEW ADENOMA

Precancerous polyps, including adenomatous and advanced polyps (polyps >10 mm, villous/tubulovillous features, and high grade dysplasia), have an increased prevalence in the older population.[6-9] In a large Veterans Affairs Hospital cohort of 17,732 asymptomatic men undergoing colonoscopy screening, the prevalence of advanced neoplasia increased from 5.7% in the youngest patients (50-59 years old) to 13% in the oldest patients (70-75 years old). Furthermore, advanced proximal neoplasia increased with age ($P<.001$): the prevalence was 2% for patients who were 50 to 59 years old, 4.9% for those who were 60 to 69 years old, and 5.9% for those who were 70 to 75 years old.[10] In another study of average risk in men and women undergoing colonoscopy screening, the prevalence and severity of neoplastic changes from adenoma through advanced adenoma to invasive carcinoma were markedly related to aging, with an odds ratio of 1.78 per increase of 10 years of age. In particular, healthy older individuals aged 76 to 80 years at average risk of CRC reported rates of advanced neoplasia and CRC (14.3% and 2.6%, respectively) that were twice as high as the rates in the main age group of 50 to 75 years.[9]

Age has been associated with several other polyp factors. In addition to adenomatous polyps, sessile serrated adenomas have been associated with increasing age,[8] as have larger and more right-sided polyps.[11,12] Furthermore, older men tend to have a higher prevalence of adenomatous polyps than do older women.[9,10]

Although the risk of adenoma and CRC is significantly affected by age, the recurrence of polyps and advanced polyps have not been associated with increased age.[13-15] Only 1 study reported that older age (≥60 years) was a factor associated with recurrent polyps and advanced lesions, but this was not a substantial independent variable in a multivariate analysis.[16] Factors on index colonoscopy such as large polyps (polyp ≥1 cm),[15] number of polyps,[17] insufficient bowel preparation/incomplete examination, and incomplete resection of polyps[18] were more associated with recurrence. Two meta-analyses reported that the number of polyps, size of polyps, and polyp histology were most strongly associated with advanced adenoma on surveillance colonoscopy.[19,20] However, Martinez et al[19] did report that in multivariate analyses, older age was associated significantly with an increased risk of metachronous advanced neoplasia.

DECISION TO SCREEN OR NOT TO SCREEN

The decision to screen older adults for CRC is complex. Although the current US Preventive Services Task Force[4] guideline recommends against screening in patients older than 85 years,[2] there are no data that the benefits of screening cease at any particular age alone as the only factor in consideration. Although, at a population level, the overall benefit of screening may be less clear, one must assess the risks and benefits of screening older adults at an individual level and not simply based on age. Older adults are at an increased risk of CRC in general and of developing more advanced CRC.[1] However, detecting disease early in its course is associated with better surgical outcomes (eg, eradicating stage 1 CRC) and tolerance of the operations themselves in this population.[21,22] To that end, discontinuing screening may portend a worse outcome in cases in which CRC is detected only at a more advanced stage without curative possibilities.

To determine who may benefit from screening, one must balance the risk of morbidity and mortality from cancer against the individual mortality risk related to other competing health factors (Figure 3). For the clinician, estimating life expectancy for an individual is challenging. Diseases such as congestive heart failure, end-stage renal disease, advanced chronic obstructive pulmonary disease, advanced dementia, and severe functional limitations in activities of daily living all predict a shorter life expectancy compared with age-matched controls. Previously developed tools, such as the National Center for Health Statistics Life tables

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of the United States, may aid in predicting the life expectancy of a patient of a particular age and race [23]; however, it does not account for compounding health factors nor does it incorporate functional status. ePrognosis (http://cancerscreening.eprognosis.org/screening/) can also be used as a tool to aid in predicting life expectancy and takes into consideration the overall assessment of a patient's health, age, comorbidities, and cognition.[24] Cognitive and capacity assessments are necessary to ensure that patients are able to engage in shared decision making appropriately and are recommended by the consensus guidelines from the American Society of Gastrointestinal Endoscopy (ASGE) in older adults.[12]

Once life expectancy is estimated, the clinician can then assess whether a screening test is appropriate. In general, for CRC, the lag time for benefit from screening is approximately 10 years.[25,26] Putting this in context, if a patient's life expectancy is estimated to be less than 10 years, screening for CRC would be unlikely to provide a mortality benefit to the patient. In contrast, a "healthy" 85-year-old individual without any significant comorbidities and excellent functional status is likely to have a life expectancy of 10 years or more and may reap benefits of screening for CRC, given the increased prevalence of adenomatous polyps above the age of 75.

HOW TO SCREEN FOR CRC

Although there are a number of tests available to screen for CRC, most have not been validated in an elderly cohort and extrapolated evidence is used from available data in younger patients. The decision about which test one chooses is based on a discussion with the patient and the risk/benefit of each test and any follow-up testing that may be required after a positive test result (Table 1).

Screening tests can be categorized into invasive and noninvasive modalities. Invasive modalities include colonoscopy, sigmoidoscopy, capsule colonoscopy, and computed tomographic (CT) colonography. Noninvasive testing options include stool guaiac fecal occult blood test (FOBT), fecal immunochemical test (FIT), stool DNA testing, and blood testing.

INVASIVE MODALITIES WITH DIRECT VISUALIZATION OF POLYPS

Colonoscopy

Although colonoscopy has traditionally been considered the criterion standard for colon cancer screening, there are no randomized controlled trials specifically performed in the older population. However, 1 prospective study indicated a 50% reduction in the incidence of CRC in older adult individuals 75 years and older if their last procedure was more than 5 years ago.[27] To prevent 1 CRC, the number needed to screen (NNS) is estimated to be 126 in men and 98 in women aged 75 to 79 years.[28]

The main benefit of colonoscopy is that it enables both screening and polyp removal in a single procedure. With adequate resection of polyps, the risk of CRC should be mitigated. Although the procedure is cost-effective, the risk of complications is increased in older adults. Possible complications include perforation, gastrointestinal bleeding, and cardiovascular risks associated with anesthetic agents.[29] In particular, an increased risk of gastrointestinal perforation may occur in the older population, especially in those with previous operations and adhesions.[30] Although infrequent, if any of these complications do occur, the resultant morbidity and cost can be substantial.

Sigmoidoscopy

Sigmoidoscopy has been studied mostly in Europe as a means to screen for CRC. The Prostate, Lung, Colorectal, and Ovarian Cancer Screening Trial included 20,726 patients who were 70 years and older. This cohort had a 20% reduction in the incidence of CRC and a 35% reduction in mortality. The NNS to prevent a case of CRC was 282.[31] When using sigmoidoscopy as a means to screen for CRC, it is important that the bowel preparation is adequate (able to identify polyps $\geq$5 mm) and the splenic flexure is reached. Although the procedure can be done without

sedation, the ability to reach the splenic flexure is often decreased because of patient discomfort.[32] Although risks are typically considered to be somewhat less than those in colonoscopy, if sedation is required, the cardiovascular risks associated with this persist. In addition, it should be noted that the right colon is not evaluated with sigmoidoscopy and thus lesions in the right side, including sessile serrated adenomas, may be missed.

Capsule Colonoscopy

Capsule colonoscopy is Food and Drug Administration approved for patients who have undergone previous incomplete colonoscopies requiring proximal colon imaging and in patients who are at a higher risk of colonoscopy or sedation.[12] The study is limited because of issues with incomplete examinations due to poor bowel preparations.[33] Capsule endoscopy has not been studied in older adults. An important limitation of capsule colonoscopy is that it requires an extensive bowel preparation to be able to evaluate mucosa completely. Despite taking the bowel preparation, lesions identified subsequently require the patients to potentially undergo a second procedure, that is, colonoscopy, if anything is identified. Even though capsule colonoscopy is generally safe in the elderly, it does carry a few risks. There is still the risk of the bowel preparation and electrolyte abnormalities. In addition, there are risks of choking on the capsule, aspiration of the capsule, and developing a retained capsule due to narrowing anywhere in the gastrointestinal tract.

Computed Tomographic Colonography

Computed tomographic colonography is an imaging modality with a sensitivity of 82% to 92% for adenomas 1 cm or greater in size.[34,35] Bowel preparation is still required for this study. Administration of carbon dioxide insufflates the colon through a rectal catheter. Normally, pressure in the colon is monitored to reduce the potential risk of perforation. Recommendations by the US Multi-Society Task Force (US-MSTF) still recommend proceeding with colonoscopy for those with polyps greater than 6 mm.[36] Although the Food and Drug Administration has approved this for screening of asymptomatic patients older than 50 years,[2,36] this has not been specifically evaluated in older adults. The overall accuracy of the test is limited by the adequacy of the bowel preparation and the distention of the lumen. In 1 study of CT colonography in patients older than 65 years, older patients tended to have poorer insufflation with evidence of retained fluids in the colon compared with younger patients. Notably in this particular study, this did not lead to significant differences in polyp detection between the 2 groups.[35] Computed tomographic colonography is not without risk. The bowel preparation carries risk, exposure to radiation from the CT scan, and the risk of perforation from insufflation of air. Another potential issue associated with CT colonography is incidental findings and the subsequent need for further work-up of these findings.

Noninvasive Modalities

When considering any of the noninvasive modalities, the physician must first determine reasonable options for which the patient is a reasonable candidate and ensure that the patient is willing to pursue colonoscopy if the result is positive. All the noninvasive modalities are associated with false positives and lack adequate positive predictive value to diagnose cancer alone. Therefore, if a patient is not willing to consider undergoing colonoscopy after a positive test result or is in too poor health to undergo the procedure safely, then one should consider reframing the discussion around colorectal screening in general.

Fecal Occult Blood Test

Multiple studies with a large sample size of 50,144 older adult patients aged 70 to 80 years have found a mortality benefit when screening with FOBT. Fecal occult blood test screening is associated with an 11% to 16% reduction in mortality from CRC.[37] Overall, the NNS to prevent 1 CRC-related death with FOBT screening in men aged 75 to 79 years was 525 and 408 in similarly aged women.[28] Serial FOBTs must be performed, as a single FOBT performed during digital rectal examination is not adequate

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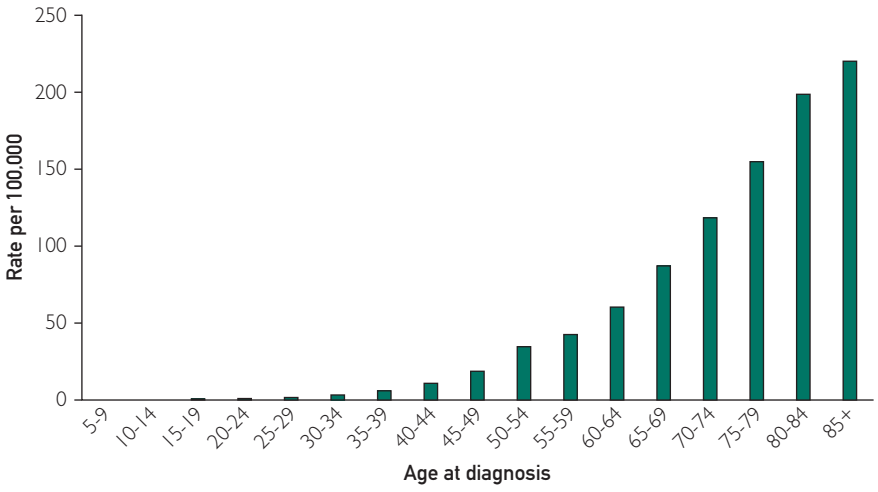

FIGURE 1. The Surveillance, Epidemiology and End Results Program data on age-specific colon cancer incidence rates from 2011 to 2015.

for CRC screening. Unfortunately, the test is associated with a high rate of false positives (86%-98%), as there are many reasons why an individual may have small amounts of blood in stool. Although the American Cancer Society (ACS) guidelines still acknowledge its use as an acceptable modality for CRC screening,[38] the US-MSTF guideline has recommended against its use given the high rates of false-positive results.[36] An FOBT is highly sensitive for any occult blood, regardless of source. Given a positive result would trigger further invasive work-up with colonoscopy, performing an FOBT in an older adult patient as a means to screen for CRC is not without risk. Therefore, caution should be exercised if one opts to screen using the FOBT and the patient should have a clear understanding of the risks associated with its use.

Fecal Immunochemical Test

The fecal immunochemical test is a FOBT that uses a specific antibody for human

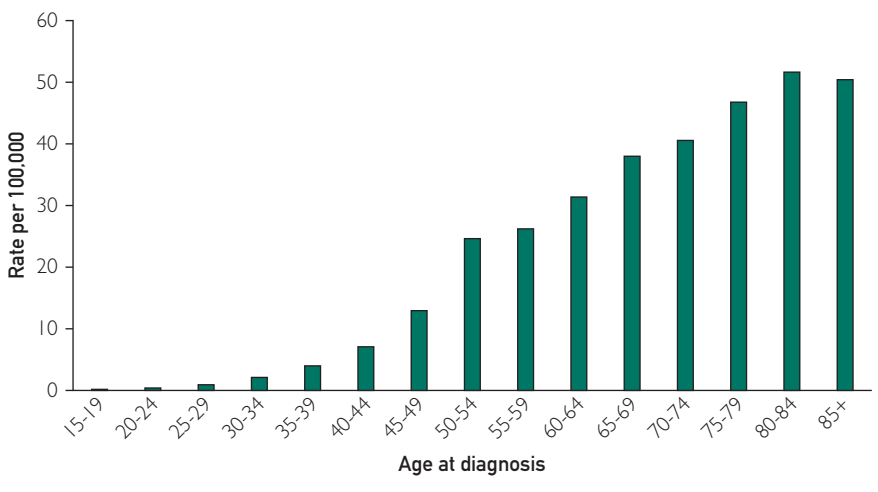

FIGURE 2. The Surveillance, Epidemiology and End Results Program data on age-specific rectal cancer incidence rates from 2011 to 2015.

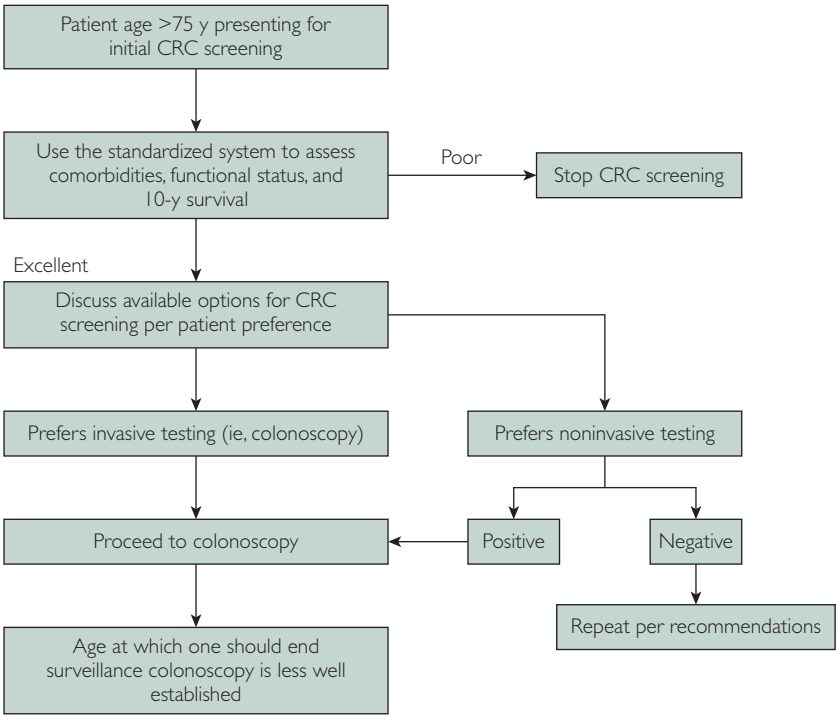

FIGURE 3. Algorithm for screening for colorectal cancer in the elderly.

hemoglobin. The fecal immunochemical test is being used more frequently and is recommended by both the ACS guideline and the US-MSTF guideline given its improved sensitivity and specificity over FOBT.[36,38] One study examined the use of FIT in patients aged 50 to 69 years old but did not analyze the data based on patient age.[39] In another study, FIT was compared with multi-DNA stool testing in patients 50 to 84 years of age.[40] In this study, the sensitivity of FIT for the detection of cancer or advanced precancerous lesions did not differ significantly according to age. Similar to an FOBT, a positive FIT result does require full colonoscopy for further evaluation, thus adding the potential risks associated with colonoscopy.

Stool DNA Testing

Multitarget stool DNA testing is a recent addition to the CRC screening armamentarium. In 2014 it was compared with FIT in 9989 participants, of whom 903 were 75 years and older.[40] In this study, the sensitivity for detecting CRC was 92.3% with stool DNA testing compared with 73.8% with FIT. The sensitivity for detecting advanced precancerous lesions was 42.4% with stool DNA testing compared with only 23.8% with FIT. However, the validity of stool DNA testing evaluated in this study is limited to the 903 patients of this study and this study was not powered to evaluate the effectiveness of stool DNA testing in the elderly. As per the ACS guideline,[38] this study is not recommended for those older than 85 years. That being said, stool DNA testing has a significant appeal in that it is highly sensitive for advanced polyps and is extremely safe to administer. Nevertheless, given that a positive result would require colonoscopy, patients who are not medically clear for colonoscopy should not undergo stool DNA testing.

Blood Testing

Septin 9 is a CRC screening marker to assess CRC. Methylated septin 9 has been found to correlate with early CRC carcinogenesis, and detecting this in blood using real-time

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TABLE 1. Key Features, Risks, and Benefits of Available Screening Modalities in CRC

Screening test	Key features	Risks	Benefits
Colonoscopy	Criterion standard; 50% reduction in CRC incidence in older adults	Highest rate of complications: perforation, gastrointestinal bleed, and cardiovascular risks; requires bowel preparation	Polyp removal at the time of screening
Sigmoidoscopy	20% reduction in CRC incidence in older adults; 35% reduction in mortality	Right colon not evaluated; cardiovascular risks associated with sedation if used; requires bowel preparation	Fewer complications than in colonoscopy; may be able to perform without sedation
Capsule colonoscopy	Not studied in older adults	Requires colonoscopy if lesions visualized; requires bowel preparation; incomplete visualization if poor preparation; risk of aspiration of the capsule and retained capsule	No sedation required; if no lesions detected and adequate preparation, can provide reassurance without risks of invasive testing
CT colonography	Not studied in older adults; requires adequate insufflation, which may prove more challenging in older adults	Requires colonoscopy if lesions visualized; requires bowel preparation; radiation exposure; risk of perforation from insufflation; incidental findings	No sedation required; if no lesions detected and adequate preparation, can provide reassurance without risks of invasive testing
FOBT	11% to 16% reduction in mortality from CRC in older adults; highest false-positive rate of noninvasive testing options	Requires colonoscopy if positive results; high false-positive rate (US-MSTF recommends against its use as a result)	If negative results, may provide reassurance without risks of invasive testing
FIT	Sensitivity for detecting CRC in older adults higher than that with FOBT but lower than that with multi-target stool DNA testing (73.8%)	Requires colonoscopy if positive results	Improved sensitivity and specificity compared with FOBT; if negative results, may provide reassurance without risks of invasive testing
Stool DNA testing	Highest sensitivity for detecting CRC (92%) compared with FIT; best sensitivity	Requires colonoscopy if positive results	Improved sensitivity and specificity compared with other noninvasive testing; highly sensitive for advanced polpys; if negative results, may provide reassurance without risks of invasive testing
Septin 9 blood testing	Specificity as high as 92%; limited data in the elderly	Requires colonoscopy if positive results; false-positive risk may increase with age	If negative results, may provide reassurance without risks of invasive testing

CRC = colorectal cancer; FIT = fecal immunochemical test; FOBT = fecal occult blood test; US-MSTF = US Multi-Society Task Force; USPSTF = US Preventive Services Task Force.

TABLE 2. Bowel Preparations and Concerns in Older Patients

Colonoscopy preparations	Comments for use in the older population
Preferred preparation in the older population	
Polyethylene glycol (eg, Miralax, Golytely, Moviprep, and Nulytely)	Considered safer because of osmotically balanced, nonabsorbable electrolyte solutions that cleanse the bowel by simple washout of the ingested fluid without significant fluid and electrolyte shifts Usually large volume (eg, 2-4 L), which can limit the completion of the entire preparation Should not be absorbed systemically
Use with caution in the older population	
Magnesium citrate, Prepopik, Clenpiq, and Suprep	Increased renal complications compared with other formulations Volume depletion
Oral sodium phosphate and oral sodium phosphate tablets (OsmoPrep)	Hyperosmolar solution to draw plasma water into the bowel lumen to achieve the fluid washout—dose adjustment recommended in the elderly but rarely done clinically Increased renal complications compared with other formulations Volume depletion
Adjuncts to bowel preparations: use with caution in the older population	
Bisacodyl	Rare reports of ischemic colitis
Metoclopramide	Limited benefits Tardive dyskinesia
Direct visualization methods/invasive	Frequency (with negative findings)
Sigmoidoscopy	Every 5 y
Colonoscopy	Every 10 y
CT colonography	Every 5 y
Capsule endoscopy	Every 5 y
Stool-based tests/noninvasive screening methods	
FOBT	Every year
FIT	Every year
FIT-DNA	Every 1-3 y

CT = computed tomographic; FIT = fecal immunochemical test; FOBT = fecal occult blood test.

polymerase chain reaction allows its use as a noninvasive screening test.[41] The specificity for neoplasia is reported as high as 92%.[42] Data from elderly patients are limited. Church et al[42] reported on 35 patients who were 65 years and older and found higher sensitivity and specificity in patients younger than 65 years, but this did not reach statistical significance. In the elderly, it needs to be used cautiously, as the false-positive rate increases with age. This increase can result in increased patient harms from anxiety and unnecessary invasive procedures. Finally, septin 9 testing is not a confirmatory test for colon cancer and any positive result requires follow-up with colonoscopy or other invasive diagnostic test for colon cancer. Septin 9 testing is currently not recommended by major gastroenterology societies.[2,12]

RISKS ASSOCIATED WITH SCREENING MODALITIES IN THE ELDERLY

The main risk of the noninvasive modes of screening is the false-positive rates associated with the tests. The positive test result requires further testing with colonoscopy, which then carries the risks associated with the procedure as mentioned below. In addition, however, if nothing is identified on colonoscopy after another modality returned a positive result, it is difficult to ascertain whether the negative colonoscopy result is a true negative or a false negative given the initial positive noninvasive test result. Significant patient anxiety and distress may occur as a result of the initial positive results, subsequent inconclusive results, and overtesting by clinicians to provide a higher degree of certainty.

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TABLE 3. Colorectal Screening in the Older Population With Screening Choices

Society	Recommendations for 76- to 85-y-old	Recommendations for >85-y-old
USPSTF and the American Cancer Society	Recommend against routine screening for colorectal cancer in adults aged 76-85 y. There may be considerations that support colorectal cancer screening in an individual patient	Recommend against screening
American College of Gastroenterology	Age to stop is not specified	Not specified
American Gastroenterology Association	Screening is potentially beneficial in persons up to the age of 86 y if there has not been previous screening, but should be considered in the context of comorbidities and life expectancy. Persons with previously negative screening test results, particularly negative screening colonoscopy results, could consider stopping at the age of 75 y	Not specified
American Society of Gastrointestinal Endoscopy	Screening is potentially beneficial in persons up to the age of 86 y if there has not been previous screening, but should be considered in the context of comorbidities and life expectancy. Persons with previously negative screening test results, particularly negative screening colonoscopy results, could consider stopping at the age of 75 y	Not specified
American College of Physicians	For those older than 75 y and individuals whose life expectancy is estimated to be <10 y, screening is not recommended	Not specified
National Comprehensive Cancer Network	Screening should be an individual decision and can be discussed for individuals aged between 75 and 85 y	Not specified
US Multi-Society Task Force on Colorectal Cancer	Screening should be considered for individuals without previous screening between the ages of 75 and 85 y	Not specified

Colonoscopy

Colonoscopy is associated with a number of potential complications. The bowel preparation, colonoscopy itself, and sedation used during the procedure are all associated with risks of complications. Most of the complication rates are higher in patients 65 years and older, with increasing complications associated with increasing age.[30]

Bowel preparation can result in many complications. The preparation is necessary to provide an adequate visualization of the mucosa and screening for colon cancer. If bowel preparation is inadequate, procedural and anesthesia time increases and thus also increases the risks. Colonoscopy in the elderly may be more difficult, as older adults are more likely than younger patients to have poor preparations. In a 2002 study, patients older than 80 years had lower colonoscopy completion rates. This was attributed to preparation quality, with poor colonic preparations being significantly more common in the octogenarian group (16%) compared with the non-octogenarian group (4%).[43,44]

Some bowel preparations (eg, oral sodium phosphate and magnesium citrate) are associated with an increased risk of renal complications in older adults[45-47] (Table 2). In addition, all options for preparation are associated with a risk of volume depletion, renal impairment, and electrolyte abnormalities. This can lead to alterations in mental status, including acute onset delirium, and falls with resultant complications in older adults. Split-dosing bowel preparations, although associated with better clearance of stool in the colon, may increase falls and cognitive changes related to early morning wake-ups and related sleep deprivation.

The procedure itself is associated with many complications. Day et al[30] reported in a systematic review that all-cause complications (ie, perforation, bleeding, cardiac, and pulmonary complications) were 25.9 per 1000 colonoscopies in patients older than 65 years and 34.8 per 1000

colonoscopies in patients older than 80 years. Although the risk of perforation during colonoscopy is overall low (1 per 100,000 colonoscopies), it is 30% higher in patients older than 65 years than in younger cohorts. Mortality is similarly low at 1 per 100,000 colonoscopies. The risk of bleeding is higher with polyp resection, which is more likely in older adults given the higher risk of adenomatous polyps.

Completion rates vary from 78% to 86% in older adults in general and from 52% to 95% in the very old (older than 80 years).[43,48–50] Unfortunately, incomplete colonoscopy is associated with higher rates of interval CRC.

Sedation

Multiple studies focusing on procedural sedation in older adults suggest that there is an increased risk of hypoxia, aspiration, hypotension, and arrhythmias compared with younger patients.[48,51] Most of these studies have examined use of a benzodiazepine (eg, midazolam) and a narcotic agent (eg, fentanyl). The ASGE issued the following recommendations to reduce risk associated with anesthetic use in older adults undergoing endoscopic procedures: (1) to use fewer sedative agents at doses lower than those used in younger patients and (2) to administer medications using slower infusion rates.

Alternatively, propofol has been found to be safe and effective in older cohorts.[52] The ASGE also recommends, similar to the combination of benzodiazepine and a narcotic agent, that the dose be lowered and administered slowly in the elderly.[12]

WHEN SHOULD SCREENING BE DISCONTINUED AND HOW TO DISCUSS THIS WITH YOUR PATIENTS

A decision-making approach should be used when deciding to initiate, continue, or discontinue CRC screening in older adults. Discussions should include the risks of the screening test itself, the risks of a potential treatment(s) if CRC was detected during screening, and the risk of morbidity and mortality from CRC if present and left untreated. Patient preferences should be thoroughly explored. Stopping screening for CRC should be considered in patients who have an estimated life expectancy of less than 10 years, especially in patients who have a significant comorbidity burden that leaves them in poorer health. The discussion should be targeted to the health literacy of the individual, including decision-making aids when appropriate. Primary decision makers other than the patient (eg, health care proxy and next of kin) should be included in the discussion based on patient preference and/or if the patient lacks capacity to fully weigh the risks and benefits of this complex decision independently. Regardless of the decision made, the provider should thoroughly document details of the discussion, including the factors that have led the patient and provider to pursue screening or not (Table 3).

CONCLUSION

Current societal guidelines suggest discontinuing colonoscopy screening at the age of 75 years and no screening for those older than 85 years. Although there is a balance between risk and benefit in colon cancer screening in the elderly, there is general consensus that an age cutoff is not the sole factor contributing to colon cancer screening decision making. Instead, balancing the risks and benefits of further screening in the older population should be between the provider and the patient, taking into account personal preferences, comorbidities, functional status, and life expectancy.

Abbreviations and Acronyms: **ACS** = American Cancer Society; **ASGE** = American Society of Gastrointestinal Endoscopy; **CRC** = colorectal cancer; **CT** = computed tomographic; **FIT** = fecal immunochemical test; **FOBT** = fecal occult blood test; **NNS** = number needed to screen; **US-MSTF** = US Multi-Society Task Force

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The Thematic Review on Gastroenterological Diseases will continue in an upcoming issue.

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