

Screening for Colorectal Cancer

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Readings

- Levin B, Lieberman DA, McFarland B, et al. [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](#). CA A Cancer Journal for Clinicians. Published online ahead of print, March 5, 2008.
- Pignone M, Rich M, Teutsch SM, et al. [Screening for colorectal cancer in adults at average risk: A summary of the evidence for the U.S. Preventive Services Task Force](#). Annals of Internal Medicine 2002, 137(2): E132-E141.
- Winawer S, Fletcher R, Rex D, et al. [American Gastroenterological Association: Colorectal cancer screening and surveillance: Clinical guidelines and rationale-Update based on new evidence](#). Gastroenterology 2003, 124: 544-560.
- Collins JF, Lieberman DA, Durbin TE, et al. [Accuracy of screening for fecal occult blood on single stool sample obtained by digital rectal examination: A comparison with recommended sampling practice](#). Annals of Internal Medicine. 2005;142(2):81-85.

Screening for Colorectal Cancer

Educational Objectives

Upon completion of this program, participants will be able to:

- Describe the burden of suffering in the United States due to colorectal cancer.
- Describe racial, ethnic, and socioeconomic disparities in CRC incidence, mortality, and screening rates.
- Identify the most current colorectal cancer screening guidelines.
- Describe the use of each of the screening methods considered acceptable by the American Cancer Society:
 - stool testing (FOBT, FIT, sDNA)
 - flexible sigmoidoscopy (FS)
 - colonoscopy
 - double contrast barium enema (DCBE)
 - CT colonography (CTC)
- Facilitate shared decision making through the explanation of test preparation, performance, benefits and drawbacks for each screening method.
- Instruct patients with regard to dietary and pharmacologic restrictions and preparation prior to each form of screening.
- Instruct patients in the proper techniques to complete stool testing and in what to expect during FS, DCBE, colonoscopy, and CTC.
- Inform patients of the necessary follow-up when results are positive.
- Describe new colorectal cancer screening modalities currently under investigation.

Why Screen for Colorectal Cancer?

Colorectal Cancer (CRC) is the third most common form of malignancy among both men and women and the second overall leading cause of cancer deaths in the United States. [American Cancer Society](#) (ACS) projections for the year 2008 include 148,810 new cases of colorectal cancer, and 49,960 deaths from CRC. (1) This accounts for about 10% of all cancer deaths.

The encouraging news is that **CRC is preventable** through appropriate screening measures. Morbidity and mortality from CRC can be reduced significantly through early detection and removal of [adenomatous polyps](#) or localized cancerous lesions.

Natural History of CRC

Development of CRC is a slow, progressive process. Over 95% of colorectal cancers arise from benign adenomas, a majority of which are polypoid. (6) Malignant transformation of adenomas depends largely on their tissue classification (tubular, villous, or tubulovillous) and their size. Villous adenomas and those greater than or equal to 1cm carry a greater potential for transformation. (7)

The natural history of the sequence from the beginning of adenomatous polyp growth to the development of cancer is about 10-15 years. (8) This unusually long pre-clinical phase means that there is a high potential for screening to reduce both morbidity and mortality. **The goal of CRC screening is to detect and remove lesions at the earliest, most benign stage possible.**

Screening and CRC Survival

As with other malignancies, 5-year survival depends on stage at diagnosis. Screening increases the chance of catching CRC at an early stage.

Stage of Disease	5-Year Survival rate
Localized	90%
Regional	68%
Distant	10%

Ries L, Melbert D, Krapcho M, et al. SEER Cancer Statistics Review, 1975–2004. Bethesda, MD: National Cancer Institute; 2007.

- **Localized** disease is defined as an invasive malignancy confined to the organ of origin.

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- **Regional** disease is defined as a cancer that has affected adjacent organs or lymph nodes or both.
- **Distant** disease is defined as a malignancy that has metastasized.

Incidence rates of CRC have declined over most of the last twenty years. New cases have decreased from 66.3 per 100,000 people in 1985 to 48.2 cases per 100,000 in 2004. Incidence rate decreased most quickly from 1998 to 2004, at 2.3% per year; this is thought to be due in part to an increase in screening. (13)

When to Screen

The lifetime risk for developing CRC for both men and women is approximately 1:19 or 5.4%. (21) However, risk changes dramatically with age. In fact, 90% of people who are found to have CRC are 50 years or older.

The ACS, as well as many major authorities including the United States Preventive Services Task Force and the American College of Gastroenterology, advocates **regular CRC screening for average risk, asymptomatic patients beginning at age 50.** (13,9)

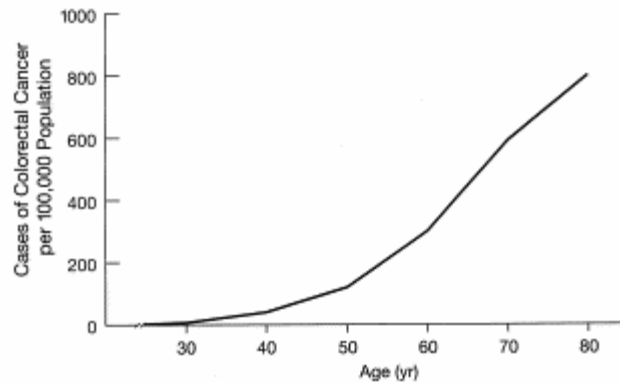


Figure 1. Age-incidence curve for colorectal cancer for an average-risk population. For those without a significant family history or other predisposing factors, the risk begins to increase substantially after age 50. (American Gastroenterological Association.)

Quality Measurements

In 2004, the National Committee for Quality Assurance (NCQA) announced a colorectal cancer screening measure to be included in the Health Plan Employer Data and Information Set (HEDIS). HEDIS is a national system that monitors the quality of care and the performance of managed care plans. The colorectal cancer screening measure is consistent with the screening recommendations supported by the CDC and the U.S. Preventive Services Task Force. Recent updates to the American Cancer Society guidelines are not reflected, as of early 2008.

The measure assesses the proportion of eligible health plan members between the ages of 50 and 80 who have received either fecal occult blood testing within the past year, flexible sigmoidoscopy within the past 5 years, colonoscopy within the past 10 years, or double contrast barium enema within the past 5 years. (4)

Screening Options

The ACS, in a 2008 guideline issued in cooperation with the US Multi-Society Task Force on Colorectal Cancer and the American College of Radiology, recommends that both men and women follow one of the following screening regimens. (The US Multi-Society Task Force comprises the American College of Gastroenterology, American Gastroenterological Association, and American Society for Gastrointestinal Endoscopy.) There is insufficient data to determine which screening test is best in terms of balance of benefits and potential harms or cost-effectiveness. Since each option has advantages and disadvantages, the choice of screening modality should be based on patient preference, medical contraindication, patient adherence, and available resources for testing and follow-up. (2)

In addition, the current ACS guideline emphasizes the fact that some tests are more likely than others to detect precancerous polyps. Imaging tests and direct visualization will reveal both polyps and cancerous tumors, with the potential to prevent cancer via colonoscopic clearing of polyps. Tests that reveal blood or tumor DNA in the stool primarily serve to detect cancer. In either case, if cancer is detected, screening increases the chance that it will be found at an early, treatable stage.

Testing Options for the Early Detection of Colorectal Cancer and Adenomatous Polyps for Asymptomatic Adults Aged 50 Years and Older

Tests that Detect Adenomatous Polyps and Cancer

Flexible sigmoidoscopy every 5 years, or
Colonoscopy every 10 years, or
Double-contrast barium enema every 5 years, or
Computer tomographic colonography every 5 years

Tests that Primarily Detect Cancer

Annual guaiac-based fecal occult blood test with high test sensitivity for cancer, or
Annual fecal immunochemical test with high test sensitivity for cancer, or
Stool DNA test with high sensitivity for cancer, interval uncertain

Adapted from: Levin B, et al. Screening and surveillance for the early detection of colorectal cancer and adenomatous polyps, 2008: a joint guideline from the American Cancer Society,

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the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. CA Cancer J Clin. March 5, 2008; e-pub ahead of print.

As of early 2008, the CDC (incorporating the 2002 U.S. Preventive Services Task Force [USPSTF] recommendations) continued to support the following screening options:

Screening test	Interval
Fecal Occult Blood Test	Annually
Sigmoidoscopy	Every 5 years
Colonoscopy	Every 10 years
Double Contrast Barium Enema	Every 5 years

Source: http://www.cdc.gov/cancer/colorectal/basic_info/screening/guidelines.htm

Screening Utilization

Despite extensive literature on the burden of disease and the guidelines of national authorities, CRC screening is still underutilized. In the 2003 National Health Interview Survey (NHIS), screening rates varied by gender, race, education, health insurance coverage, and immigration status, but were lowest for those without insurance. (19) Poor and uninsured people are more likely to be treated for cancer at later stages and therefore more likely to die from cancer than people of higher socioeconomic status.

The NHIS revealed that only 16.3% of non-Hispanic white adults had a fecal occult blood test (FOBT) within the last year and only 37.5% had some form of endoscopy within the past five years. African American adults had similar rates of FOBT screening; the endoscopy rate was lower at 32.6%. Hispanic men and women were even less likely to be screened for CRC, with rates of 11.9% for FOBT within the last year and 25.1% for endoscopy. (19) All of these screening rates fell far short of the ACS 2015 objectives of 75% for people over the age of 50.

Racial Disparities in Colorectal Cancer

Overall, African Americans are more likely to develop and die from cancer than any other ethnic or racial group. (13) Both incidence rates and mortality for CRC are higher than in whites. Among African American adults, CRC is the third leading cause of cancer mortality. The five-year survival rate for CRC in African Americans during the period from 1996-2002 was 57%. This is an improvement over the 1975-77 rate of 46%. However, the improvement was smaller than that for whites, for whom five-year survival increased during the same time period from 51% to 66%. This disparity is at least partly attributable to the later stage at diagnosis for African Americans (18)

CRC incidence and mortality rates for Hispanic men and women are lower than those for African Americans and non-Hispanic whites, but CRC remains the third most commonly diagnosed cancer among Hispanic adults. In addition, it is the third leading cause of cancer death in Hispanic women and matches prostate cancer as the second leading cause of cancer death in Hispanic men. As with African Americans, the annual reduction in CRC mortality in Hispanics in the 1990s was smaller than that for non-Hispanic whites. (20)

Stool Testing

Stool testing, by one of three methods, is considered an effective method of CRC screening. Several large-scale studies have demonstrated that annual fecal occult blood testing (FOBT) using a guaiac-based test can decrease CRC mortality by 15-33%. However, guaiac FOBT can be highly variable in sensitivity and specificity, depending on the brand or variant, collection technique, number of samples, whether samples are rehydrated, and how the results are interpreted. Fecal immunochemical testing (FIT) has some technical advantages over guaiac FOBT, including the elimination of false negatives due to diet, although it has not been shown to have better overall accuracy than a sensitive guaiac FOBT (Hemoccult SENSE). Stool DNA testing (sDNA) is not as well studied as FOBT and FIT, but is also considered an acceptable option in the current ACS guideline. (2)

Guaiac FOBT

Guaiac FOBT has been shown, in randomized controlled trials, to be an effective screening method, with cancer detected at an earlier stage using these tests than in unscreened patients. For guaiac FOBT, the ACS now recommends using only high-sensitivity tests that have been shown in the peer-reviewed medical literature to detect a majority of existing CRC in an asymptomatic population. Lower-sensitivity tests are no longer recommended. (2) The patient must complete three FOBT cards, following three consecutive bowel movements. The accuracy of the test depends on the number of samples that are tested, since polyps and cancers may bleed intermittently. A single FOBT card tested after digital rectal examination is *not* an acceptable substitute for the three-card FOBT that a patient completes at home, and using this practice for CRC screening should be abandoned. (2) Guaiac FOBT should be repeated annually.

FOBT and Dietary Restrictions. Because of potential interactions between dietary intake and guaiac-based tests, the manufacturer of a common sensitive [guaiac](#) FOBT card (Hemoccult SENSА, Beckman Coulter) recommends that patients abstain from NSAIDs for seven days, red meat for three days, and Vitamin C in doses greater than 250mg/day for three days before beginning the test and during the test period. The concern is that NSAIDs may promote GI bleeding; peroxidase in red meat may cause a false-positive; and Vitamin C appears to increase false-negative results. The current ACS guideline also highlights the potential for peroxidase-containing vegetables and certain fruits to cause false-positive results. (2) Fruits and vegetables high in peroxidase include turnips, radishes, horseradish, broccoli, cauliflower, and cantaloupe. Although recommendations for dietary restriction are routine, the precise influence of these dietary elements on test accuracy has not been established.

Some physicians feel that dietary restrictions make patients less likely to complete the FOBT cards. However, a meta-analysis of trials suggests that advice to perform modest dietary restriction during non-rehydrated FOBT does not affect the completion rate. (11)

Fecal Immunochemical Testing (FIT)

A newer version of FOBT uses immunochemical testing for human globin, a specific protein in human hemoglobin. FIT eliminates the need for dietary restrictions, does not require medication adjustments, and generally requires less handling of stool. The American Cancer Society includes FIT in their screening recommendations, noting that these tests are more specific for human blood and, because globin is degraded by enzymes in the upper GI tract, are also more specific for lower GI bleeding. (2)

Comparisons of FIT and sensitive guaiac FOBT have not shown a clear pattern of superiority for one over the other in terms of detecting cancer, although the ACS guideline notes that specificity of FIT tended to be higher. (2)

FIT should be repeated annually.

Stool DNA Testing

Stool DNA (sDNA) tests look for genetic alterations that occur in colon adenomas and colon cancer. sDNA testing has been evaluated in comparison with a low-sensitivity guaiac FOBT test in one large, prospective study of patients at average risk of colon cancer. In this study, sDNA had better sensitivity than the guaiac test. The currently offered version uses technology intended to further improve sensitivity; however, large studies on this version have not been done.

Because sDNA testing involves a limited panel of genetic markers, it is likely that it misses a certain number of cancers which do not contain those genetic changes. In addition, the significance of a positive DNA test with a negative follow-up colonoscopy is not known, and the appropriate interval between tests is uncertain. (2) However, for patients who are not willing to do more traditional stool testing, the ACS guideline includes sDNA testing as a reasonable option.

Stool Tests and Patients at Increased Risk for CRC

The above information regarding screening using stool testing applies to average risk, asymptomatic persons. Screening recommendations differ for persons at high risk of CRC. Anyone with [symptoms of CRC](#) should proceed directly to diagnostic testing.

Performing the tests

Guaiac FOBT

The following instructions are based on those for a common sensitive guaiac FOBT product. Patients should refer to the manufacturer's instructions for the test type and the specific version they are using.

For sensitive guaiac FOBT, the patient should prepare one FOBT card from each of three consecutive bowel movements. There are two test slides per card.

- ✓ Gather supplies (test cards and wooden applicator). Each test card will have 2 windows in which a stool sample will be placed. A complete fecal occult blood test consists of 3 cards, each with 2 stool samples, for a total of 6 samples. This improves the accuracy of the test.
- ✓ If the cards are not already labeled with name, age, and address, write this information in the blanks on the front of each card.
- ✓ Place a piece of plastic wrap on the toilet bowl (under the toilet seat) between seat and the toilet water, or use a clean container to catch stool. Do not contaminate stool with urine or toilet tissue.
- ✓ Use the wooden applicator to apply a thin film of stool onto one of the windows on the test card.
- ✓ Using the applicator again, take a specimen from a different place in the same stool sample and apply it to the other window on the test card
- ✓ Close the slots and write name and the date the sample was collected on the card. Store the card in a paper envelope; do not use a plastic bag or other sealed container that would prevent the slide from drying.
- ✓ Repeat the test on the next two bowel movements.

When the FOBT cards are returned, they should be developed immediately. It is recommended that samples be developed within 7 days of collection.

Controversy has surrounded the issue of whether to rehydrate stool samples. The USPSTF states that rehydrating the samples raises sensitivity but lowers specificity, increasing the number of false positives. (15) Guidelines outlined in a 2003 update from the American Gastroenterological Association recommend that the stool samples not be rehydrated. (5)

FIT

The following instructions are based on those for a common FIT product. Patients should refer to the manufacturer's instructions for the test type and the specific version they are using.

- ✓ Remove any automatic cleaning devices or bluing agents from the toilet and flush twice. If no cleaning agents are used, simply flush before your bowel movement.
- ✓ Do not place used toilet paper into the bowl.
- ✓ Brush the surface of the stool with the supplied long-handled brush.
- ✓ Dab the brush onto the test card and close the card flap.
- ✓ Repeat the test on the next bowel movement, using a new card.

FIT samples are usually processed in a clinical laboratory. Beckmann Coulter, manufacturer of Hemoccult ICT, an immunochemical test, states that samples for this FIT are stable at room temperature for 14 days. However, samples should always be sent for analysis as soon as possible after the cards are complete.

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sDNA

For sDNA testing, the entire stool specimen is used, and it must be shipped to the laboratory in a special container including an ice pack. Patients should refer to the manufacturer's instructions for the test type and the specific version they are using.

Risks of the Tests

Guaiac FOBT, FIT, and sDNA tests have minimal direct risk. The primary risk is that a false positive will lead to unnecessary colonoscopy or other further tests.

Interpreting the Tests

Even with good sensitivity and specificity, the relatively low prevalence of colorectal cancer in the general population means that many people who have positive stool tests will not have cancer. When positive, stool tests indicate the need for total colonic evaluation, which may reveal polyps or frank malignancy. For FOBT and FIT, in which a complete test involves multiple samples, a positive test is defined as one or more positive samples. The American Cancer Society recommends that patients with a positive stool test proceed directly to colonoscopy. Repeat stool testing is not recommended. Persons too fragile to undergo complete diagnostic colonic evaluation should not be screened.

Guaiac FOBT and FIT should not be performed on persons who are likely to have misleading results, such as those with actively bleeding hemorrhoids.

Flexible Sigmoidoscopy

Flexible sigmoidoscopy (FS) involves endoscopic examination of the lower portion of the colon and can be performed in an office setting without sedation. As a screening modality, FS should be repeated every five years.

The inclusion of FS among the screening options is based on high-quality cohort and case-control studies. FS appears to lead to a 60% to 80% reduction in colorectal cancer mortality, but only for tumors within the lower half of the colon; more proximal tumors cannot be detected with this method. FS has been found to be 60 to 70% as sensitive as colonoscopy for detecting advanced adenomas and cancers; however, these figures change according to age, with proximal lesions being more common in older adults. They may also differ according to gender and ethnic background. (2)

Current USPSTF and ACS recommendations allow for either stool testing or flexible sigmoidoscopy to be performed alone. However, the prior version of the [American Cancer Society](#) guideline advocated the combination of the two screening methods as preferable to either one alone. (14) The current ACS guideline suggests that consideration be given to the combination of FS every five years with annual FOBT or FIT, without making a specific recommendation about the value of this option. Sigmoidoscopy permits removal of polyps if any are detected, but visualization is limited to the lower part of the colon. Stool testing can allow detection of lesions higher up. If the two methods are combined, FOBT should be completed before sigmoidoscopy; a positive FOBT is an indication for colonoscopy, in which case sigmoidoscopy becomes redundant.

Performing the Test

FS must be performed by a trained practitioner. A [flexible sigmoidoscope](#) is inserted into the rectum to a distance of approximately 60 cm to look at the rectum and the sigmoid colon.

Preparation usually involves two Fleet enemas on the day of the examination; some patients will prefer an oral bowel preparation, such as two 10-mg bisacodyl tablets (Dulcolax) plus one bottle of magnesium citrate, taken the evening before.

The test takes between 10 and 20 minutes. There may be some discomfort, pressure or cramping. FS does not require intravenous anesthesia or medication and patients generally do not need someone to accompany them home.

Risks of the Test

Sigmoidoscopy, in rare instances, can lead to bowel perforation (less than 1 per 20,000 examinations). (2) The USPSTF cites a study that found, among 1,235 screening sigmoidoscopies, adverse effects including pain (14 percent), anxiety, bleeding (3 percent), gas or flatus (25 percent), but no perforations. (15)

Interpreting the Test

If polyps are removed and/or [biopsy samples](#) taken, these are sent to pathology for analysis to determine whether they are normal, pre-cancerous or [cancerous](#) tissue. The ACS guideline recommends that patients who are found to have adenomas be referred for colonoscopy. If biopsies are not obtained, presence of polyps >5mm may be considered reason for colonoscopy.

In addition to permitting biopsy when samples were not taken during FS, colonoscopy offers the opportunity for more thorough examination in all patients with positive findings on FS. Two large screening studies have found evidence that distal polyps are associated with increased risk of proximal advanced neoplasia. (2)

If the result of the exam is negative, flexible sigmoidoscopy should be repeated every five years in average risk patients. In centers with a high volume and documented high quality of procedures, the current ACS guideline allows for consideration of a 10-year interval.

Colonoscopy

Colonoscopy may be used as a screening method without stool testing or FS. The current ACS recommendation for asymptomatic adults over 50 years of age is that colonoscopy, if done as the primary screening method, should be repeated every 10 years. However, the precise interval needed to maximize prevention of colorectal cancer is not known.

There are no randomized controlled trials to date evaluating the impact of screening colonoscopy on CRC incidence or mortality in average risk individuals. However, there is evidence to support its effectiveness. Colonoscopy was employed in the clinical trials of FOBT, which revealed that screening decreased mortality. It is thought to be at least as good as FS, as it examines the entire colon and not just the distal segment. Colonoscopy has been shown to reduce the incidence of CRC in persons with adenomatous polyps in two cohort studies.
(5)

Performing the Test

Colonoscopy must be performed by a trained practitioner. Colonoscopy involves passing a [colonoscope](#) into the rectum. The colonoscope is used to examine the rectum and the entire colon, to determine whether [colorectal polyps](#) and/or [cancer](#) are present.

The procedure requires a complete bowel preparation with a strong laxative the day before the procedure, usually preceded by a diet of clear liquids for a day or two. Since colonoscopy usually includes the use of a sedative, the patient needs someone to take him/her home at the end of the test.

The test takes about 30 minutes. It may take longer if visualization is difficult or if multiple polyps must be removed or biopsies must be done. There may be some discomfort, pressure or cramping. The physician is usually able to remove any polyps he or she finds and to take biopsies of any suspicious lesions during the colonoscopy.

Risks of the Test

Colonoscopy does involve greater risk, cost and inconvenience than other CRC screening tests. Risks include perforation and major bleeding, as well as complications from the use of a sedative. The USPSTF notes that risk of major complications, including significant bleeding, is about 2 to 3 per 1,000 for screening colonoscopies, with higher risk for therapeutic procedures. Different studies of diagnostic colonoscopies have shown rates of bowel perforation ranging from 3 to 61 in 10,000 examinations. The risk-benefit ratio should be discussed in the framework of shared decision-making, outlined in the previous section. (5)

Interpreting the Test

[Hyperplastic](#), non-neoplastic polyps account for 10-30% of polyps detected on examination and in most cases are not clinically significant. Other benign growths include lipomas and mucosal tags. [Adenomatous polyps](#) comprise 50-70% of all polyps found at the time of colonoscopy and are usually neoplastic or pre-malignant. One-third of these lesions are found proximal to the splenic flexure. (12)

If one or more adenomas are detected, a repeat colonoscopy sooner than ten years is usually recommended. The date of this follow-up surveillance depends on the number, size, and histology of the adenomas found. Common intervals are three and five years. (6)

If the results of a screening colonoscopy are normal, the test should be repeated every 10 years in average risk patients. The ten-year interval is based on the sensitivity of colonoscopy and the rate at which advanced adenomas develop. (5) Screening intervals for higher-risk patients are beyond the scope of this workbook.

Double Contrast Barium Enema

Double contrast barium enema (DCBE) may be offered as a screening method for CRC. There are no randomized trials evaluating the impact of DCBE on CRC incidence or mortality in average risk individuals.

DCBE can detect large clinically relevant lesions, but it is less sensitive than colonoscopy. FS is not recommended as an addition to DCBE in the setting of CRC screening, because the increase in detection rate is probably small and is felt to be offset by the cost and inconvenience of FS. (5)

If DCBE is used as the screening method of choice, it is recommended every five years.

Performing the Test

[X-rays](#) are taken after the patient is given an enema with barium and air is introduced in to the colon. The barium and air help to outline the colon and rectum, making abnormalities easier to detect. The test, involving multiple x-rays with different positioning, takes about half an hour. DCBE requires bowel preparation similar to that for colonoscopy.

Risks of the Test

Perforation rates for DCBE are estimated to be about 1:25,000. (15)

Interpreting the Test

DCBE is less sensitive than colonoscopy in detecting large polyps and cancers. It does not allow for the removal of polyps or the biopsy of suspicious lesions, and it is more likely to identify artifacts, such as stool, as colonic lesions. If abnormalities are found, DCBE should be followed by colonoscopy.

CT Colonography

CT colonography (CTC) is popularly termed "virtual colonoscopy." This technology combines multiple helical CT scans to create two- or three-dimensional [images](#) showing the interior of the colon. In the past, this modality was not included among recommended screening methods. However, due to improvements in technology, the 2008 ACS guideline includes CTC as an acceptable option.

There have been no prospective, randomized controlled trials of CTC. Available studies suggest better sensitivity for polyps ≥ 1 cm than for smaller polyps. Potential limitations in the use of CTC include variations in user skill, a relatively high number of false positives and the inability to remove detected polyps, leading to the need for follow-up colonoscopy. CT colonography may be less able than colonoscopy to detect flat adenomas, which appear to be less common but more aggressive than adenomatous polyps. (17)

Performing the Test

Virtual colonoscopy requires bowel preparation similar to what is needed for a colonoscopy. Before the CT image is taken, air is introduced into the colon through a rectal catheter. Each scan is done during a single breath hold; scans must be done in both the supine and prone positions. The test itself takes about 10 minutes. CTC does not require sedation and recovery time is minimal.

Risks of the Test

Risk of colonic perforation with CTC appears to be low in the general population, with one study recording only one symptomatic perforation in almost 22,000 procedures. In symptomatic patients the risk may be higher, with reported rates ranging from 0.03% to 0.06%. (2)

The level of radiation involved in CTC has been examined for its potential to contribute to colon cancer risk. In a 50-year-old subject, the radiation dose may add 0.044% to the lifetime risk. Organ radiosensitivity decreases with age, so this estimate is lower in older patients. Risk can be reduced with low-dose protocols. (2)

Another concern is the risk of incidental findings outside the colon, which can require additional testing.

Interpreting the Test

Currently, ACS suggests colonoscopy for patients who are found to have one or more polyps ≥ 6 mm. For patients who can not have or do not want colonoscopy, surveillance with CTC appears to be an acceptable option. However, research on appropriate follow-up is limited. There is no strong recommendation for screening interval in patients with negative findings, but a 5-year interval is offered as reasonable in the ACS guideline.

New Screening Modalities

Information about the newer screening modalities is still emerging. As technology improves, sDNA testing and CTC may play a larger role, and newer options may supplant current recommendations.

Capsule video endoscopy. This procedure, which has received a certain amount of media attention, makes use of a tiny camera, built into a small pill that the patient swallows. The device takes pictures as it passes through the digestive tract. Although this technology has captured the public's imagination and has proven useful for imaging the small intestine, it is not currently recommended for CRC screening. The larger lumen of the colon makes it likely that the camera will miss significant portions of the colon wall. (17) Research is underway to develop a device that will provide adequate imaging of the colon.

Summary

Screening modality selection should be individualized to each patient, depending on patient preference, discussion of risks and benefits, access to various technologies and, in the case of imaging or direct visualization, the skill of the operator. Medical contraindications and the likelihood of patient adherence to screening regimens and to follow-up should also be considered. Patients who utilize stool testing, FS, DCBE, and CTC should be informed that positive findings usually require follow-up with colonoscopy.

Patients should also be informed about the difference between tests that detect both polyps and cancer, allowing for preventive clearing of polyps, and tests that primarily detect cancer.

The current ACS guideline, released in March, 2008, includes the following options:

- Tests that Detect Adenomatous Polyps and Cancer
 - Flexible sigmoidoscopy every 5 years, or
 - Colonoscopy every 10 years, or
 - Double-contrast barium enema every 5 years, or
 - Computer tomographic colonography every 5 years

- Tests that Primarily Detect Cancer
 - Annual guaiac-based fecal occult blood test with high test sensitivity for cancer, or
 - Annual fecal immunochemical test with high test sensitivity for cancer, or
 - Stool DNA test with high sensitivity for cancer, interval uncertain

References

1. American Cancer Society web site, Detailed Guide: Colon and Rectal Cancer, http://www.cancer.org/docroot/CRI/CRI_2_3x.asp?dt=10 Accessed 2/16/2007.
2. Levin B, Lieberman DA, McFarland M, et al. 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. *CA Cancer J Clin.* March 5, 2008; e-pub ahead of print.
3. Selected cancers: Colon and rectum. In: [Facts & Figures 2003](#). Atlanta: American Cancer Society, 2003: 11-12.
4. The State of Health Care Quality Screening 2004 New Measure: Colorectal Cancer Screening. Available at http://www.ncqa.org/communications/sohc2004/colorectal_cancer.htm. Accessed 2/16/07.
5. Winawer S, Fletcher R, Rex D, et al. American Gastroenterological Association: Colorectal cancer screening and surveillance: Clinical guidelines and rationale-Update based on new evidence. *Gastroenterology* 2003, 124: 544-560.
6. Walsh JM, Terdiman JP. Colorectal Cancer Screening: Scientific Review. *Journal of the American Medical Association* 2003, 289: 1288-1296.
7. Kim EC, Lance P. Colorectal polyps and their relationship to cancer. *Gastroenterology Clinics of North America* 1997, 26(1): 1-17.
8. Winawer SJ. Natural History of Colorectal Cancer. *Am J Med.* 1999;106(1A):3S-6S.
9. Screening for Colorectal Cancer. In: [Guide to Clinical Preventive Services, 2006: Recommendations of the U.S. Preventive Services Task Force](#). AHRQ, 2006.
10. United States Preventive Services Task Force. Screening for colorectal cancer: Recommendations and rationale. *Annals of Internal Medicine* 2002; 137:129-131. Available at: <http://www.ahrq.gov/clinic/3rduspstf/colorectal/colorr.htm>.
11. Pignone M, Campbell MK, Carr C, et al. [Meta-analysis of dietary restriction during fecal occult blood testing](#). *Effective Clinical Practice* 2001; 4:150-156.
12. Wineman AP. [Screening for colorectal cancer: Guidelines for choosing the appropriate test for each patient](#). *Postgraduate Medicine* 2003, 113(2): 49-55.
13. [Cancer Facts and Figures 2008](#). Atlanta: American Cancer Society, 2008.

14. American Cancer Society Guidelines on Screening and Surveillance for the Early Detection of Adenomatous Polyps and Colorectal Cancer. *CA-A Cancer Journal for Clinicians*. January/February 2001, Vol. 51/No. 1, 44-54
15. U.S. Preventive Services Task Force. *Screening for Colorectal Cancer: Recommendations and Rationale*. July 2002. Agency for Healthcare Research and Quality, Rockville, MD.
<http://www.ahrq.gov/clinic/3rduspstf/colorectal/colorr.htm>
16. Smith A, Young GP, Cole SR, Bampton P. Comparison of a brush-sampling fecal immunochemical test for hemoglobin with a sensitive guaiac-based fecal occult blood test in detection of colorectal neoplasia. *Cancer*. 2006 Nov 1;107(9):2152-9.
17. Levin B, Brooks D, Smith RA, Stone A. [Emerging Technologies in Screening for Colorectal Cancer: CT Colonography, Immunochemical Fecal Occult Blood Tests, and Stool Screening Using Molecular Markers](#). *CA A Cancer Journal for Clinicians* 2003;53;44-55.
18. [Cancer Facts and Figures for African Americans, 2007-2008](#) Atlanta: American Cancer Society, 2007.
19. [Cancer Prevention and Early Detection Facts and Figures, 2007](#) Atlanta: American Cancer Society, 2007.
20. [Cancer Facts and Figures for Hispanics, 2003-2005](#). Atlanta: American Cancer Society, 2007.
21. *SEER Cancer Statistics Review, 1975-2004*, National Cancer Institute. Bethesda, MD. Accessed online March 25, 2008 at http://seer.cancer.gov/csr/1975_2004.

LINKS AND DEFINITIONS

Guaiac

A tree resin that turns blue after an oxidation reaction. Paper impregnated with guaiaac can be used, with a hydrogen peroxide developer, to detect heme peroxidase activity in hemoglobin.

Symptoms of Colorectal Cancer

Symptoms of colorectal cancer may include:

- A change in bowel habits, such as diarrhea or constipation
- Narrow stools
- Blood in the stool
- Unexplained anemia
- Abdominal pain or tenderness
- Unexplained weight loss

Adenomatous Polyp

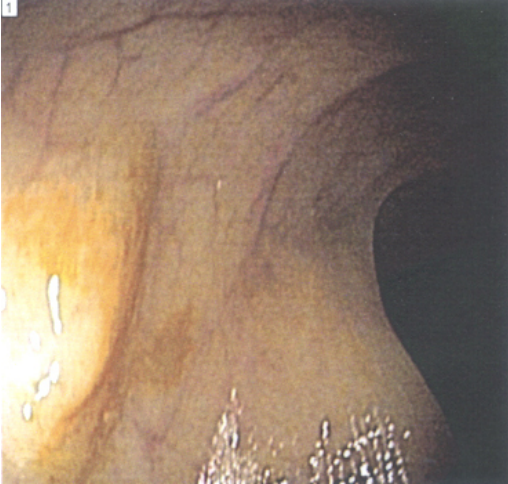
A polyp derived from glandular epithelium.



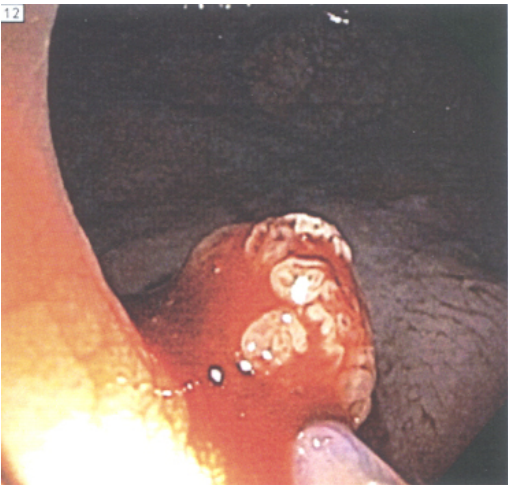
Hyperplastic Polyp

A small polyp showing lengthening and cystic dilation of mucosal glands

Screening for Colorectal Cancer



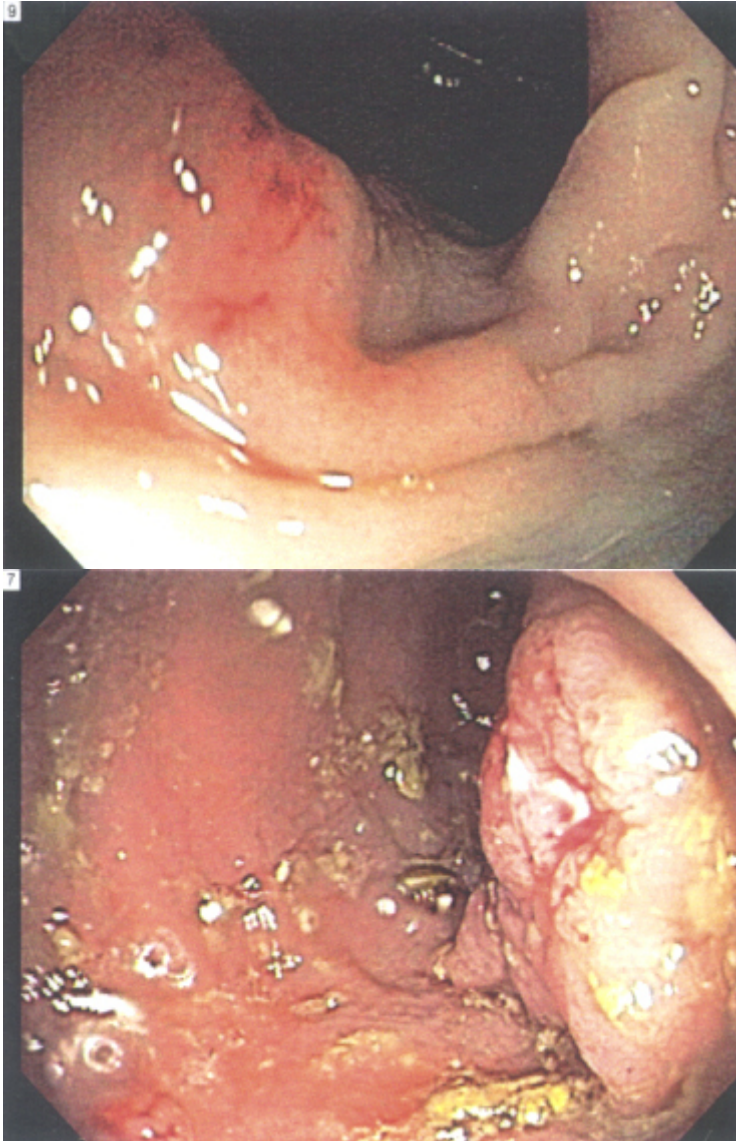
Polyp Being Removed for Evaluation



Cancer

Cancerous tumors of the colon.

Screening for Colorectal Cancer



Virtual Colonoscopy/CT Colonography

To see images from CT Colonography, visit the National Cancer Institute's Cancer Imaging Program at:

<http://imaging.cancer.gov/imaginginformation/cancerimaging>

and click on "Virtual Colonoscopy."

Sigmoidoscope and Colonoscope

Screening for Colorectal Cancer

For simple, patient-friendly diagrams of sigmoidoscopy and colonoscopy, visit the National Cancer Institute's Dictionary of Cancer Terms.

<http://www.cancer.gov/dictionary>

Double Contrast Barium Enema

For a simple, patient-friendly diagram and photo of a barium enema x-ray, visit the National Cancer Institute's Dictionary of Cancer Terms and select "Barium Enema."

<http://www.cancer.gov/dictionary>