Colorectal cancer (CRC) is the third most commonly diagnosed cancer and the second leading cause of cancer-related death in the U.S. Each year, approximately 130,000 individuals are diagnosed and over 50,000 will die from this malignancy. The 5-year survival rate for early stage cancers is over 90%, while the 5-year rate for those diagnosed with widespread cancer is less than 10%. Indirect evidence suggests that most cancers develop from adenomatous polyps and that it takes on average 10 years for a < 1 cm polyp to transform into invasive CRC. Given the finding that colon polyps and early cancers are usually asymptomatic and the above-mentioned dwell time between polyp and cancer, there appears to be a significant opportunity for CRC prevention by screening asymptomatic individuals.

Only 30% of individuals harbor risk factors for colorectal cancer. These risk factors include family history of colorectal cancer, a personal history of colon polyps or cancer, a personal history of inflammatory bowel disease, and the familial polyposis syndromes (including familial adenomatous polyposis [FAP], hereditary nonpolyposis colon cancer [HNPCC]). The other 70% of individuals are considered average risk.

There has been mounting evidence regarding the efficacy of screening average risk individuals for CRC. Prospective randomized trials of fecal occult blood testing (FOBT) have demonstrated a 15-33% reduction in CRC-related mortality. Case-control studies (mostly utilizing rigid sigmoidoscopes) have suggested a reduction in CRC-related mortality between 59-80% in the portion of the colon examined. It has been estimated that the overall reduction in CRC-related mortality from flexible sigmoidoscopy screening up until age 80 would be approximately 45%. As yet there are no published prospective trials of screening flexible sigmoidoscopy showing a diminution in CRC-related mortality.

These studies have prompted several groups to publish new guidelines for CRC screening. The American Cancer Society (ACS), the United States Preventive Service Task Force, and a consortium including the American Society for Gastrointestinal Endoscopy, American Gastroenterology Association, American College of Gastroenterology, American Society of Colon and Rectal Surgeons, Society of American Gastrointestinal Endoscopy Surgeons, initially supported by the Agency for Health Care Policy and Research (AHCPR), have all published guidelines within the past 5 years regarding CRC screening and surveillance recommendations.

**SCREENING FOR AVERAGE RISK INDIVIDUALS**

**Fecal Occult Blood Testing.**

All three groups agree that individuals at average risk for CRC should begin yearly fecal occult blood testing at age 50. The recommended method includes the patient eating a meat-free diet one day prior to stool collection. Three fecal occult blood test slides, with two windows each, should be completed by the patient. Samples obtained by digital rectal exam (DRE) and/or which include hydration have higher false positive rates. Patients with a positive FOBT have an increased risk of advanced neoplasia and should undergo a complete examination of the colon and rectum by colonoscopy. An alternative is double contrast barium enema (DCBE) and flexible sigmoidoscopy, although a total colonoscopic exam is preferred because of its superior diagnostic characteristics and the ability to remove detected lesions.

**FLEXIBLE SIGMOIDOSCOPY**

The above mentioned case-control studies have prompted guidelines recommending the utilization of flexible sigmoidoscopy as part of a CRC screening program. The ACS and the consortium recommend this procedure every 5 years starting at age 50 for average risk individuals. The United States Preventive Services Task Force also recommends this procedure but does not specify an appropriate
interval. Individuals with a polyp or polyps > 1 cm should undergo complete colon evaluation, with colonoscopy. There remains considerable controversy regarding whether individuals with adenomatous polyps less than 1 cm should undergo colonoscopy.

There is limited evidence that combining yearly FOBT and flexible sigmoidoscopy every 5 years results in better long-term survival if cancers are detected.

DOUBLE CONTRAST BARIUM ENEMA

The ACS and the consortium have endorsed DCBE every 5-10 years as an alternative for screening average risk individuals. However, at this time, there are no prospective studies demonstrating the efficacy of DCBE for reducing CRC-related mortality through screening. The addition of flexible sigmoidoscopy to DCBE should be considered due to the poor visualization of the rectosigmoid colon by DCBE alone. While DCBE offers evaluation of the entire colon, its diagnostic sensitivity is inferior to colonoscopy and it lacks therapeutic capability.

A recent, prospective study found that the sensitivity for detecting CRC was 83% for barium enema radiography versus 95% for colonoscopy.

COLONOSCOPY

Both the consortium and the ACS recommend colonoscopy every 10 years as an alternative for CRC screening. Colonoscopy offers the advantages of complete visualization of the entire colon and therapeutic potential. Currently, there are no direct studies evaluating whether screening colonoscopy alone reduces CRC-related mortality. There is indirect evidence from the FOBT trials that colonoscopy reduces CRC-related mortality. However, the performance of colonoscopy is similar to sigmoidoscopy and there is direct evidence that sigmoidoscopy is effective in reducing CRC-related mortality. The choice of modality for CRC screening should be discussed between practitioner and patient.

HIGH RISK GROUPS

Colonoscopy for cancer surveillance is appropriate in certain high-risk patients. Risk factors for colon cancer include longstanding ulcerative colitis, Crohn’s colitis, familial cancer syndromes, and personal history of colorectal neoplastic polyps or cancer.

PERSONAL HISTORY OF INFLAMMATORY BOWEL DISEASE

Individuals with longstanding ulcerative colitis or Crohn’s colitis (pancolitis for 8 or more years or, left-sided colitis for 15 or more years) may undergo colonoscopic surveillance with systematic biopsies every 1-3 years although there is no direct evidence supporting this practice. The role of colonoscopy in the management of patients with inflammatory bowel disease is discussed in another guideline.

The majority of polyps found in ulcerative colitis (UC) are inflammatory in nature. However, the finding of an adenomatous polyp in an individual with UC poses a clinical dilemma. Adenomas are, by definition, mass lesions with dysplasia. Adenomas located outside of the segment of UC may be managed similarly to polyps in individuals without UC. For adenomas found within a UC segment, limited available data suggest that, in the absence of dysplasia in the surrounding mucosa, these polyps may be managed similarly to polyps in individuals without UC. The risk of malignancy appears to be low if no dysplasia is seen in these biopsies. Further studies are needed to clarify this controversial issue.

POLYPOSIS SYNDROMES

Individuals with a family history of familial adenomatous polyposis (FAP) or Gardner’s syndrome should undergo genetic testing with counseling and annual flexible sigmoidoscopy beginning at age 10 to 12 years; colectomy should be recommended when polyposis is found. Affected individuals have nearly a 100% risk of developing colorectal cancer by the age of 40. They should be counseled regarding colectomy. If no polyps are seen, then annual sigmoidoscopy should be offered to age 40 and then every 3-5 years thereafter. Colonoscopic surveillance is not effective in preventing colon cancer in this setting.

Hereditary nonpolyposis colorectal cancer (HNPCC) should be suspected in patients with several relatives with CRC, especially if one or more of the relatives developed CRC before age 50. Genetic counseling and testing should be considered in these patients. Colonoscopic surveillance has been recommended every 2 years starting at age 25 or 5 years younger than the earliest diagnosis of CRC, whichever is earlier. Annual screening should be performed yearly after age 40.

Table 1.
Alternatives for CRC Screening in Average Risk Individuals (beginning at age 50)

<table>
<thead>
<tr>
<th>Option</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fecal occult blood testing - yearly</td>
</tr>
<tr>
<td>Flexible sigmoidoscopy - every 5 years</td>
</tr>
<tr>
<td>FOBT yearly/flexible sigmoidoscopy every 5 years</td>
</tr>
<tr>
<td>Double contrast barium enema (with FS) - every 5 years</td>
</tr>
<tr>
<td>Colonoscopy - every 10 years</td>
</tr>
</tbody>
</table>
no direct evidence regarding the appropriate interval of surveillance in these patients.

**FAMILY HISTORY OF CRC/POLYPS**

Individuals with a family history of CRC or adenomas (other than FAP and HNPCC) are also at increased risk\(^30\) for the development of CRC compared to the general population. It is recommended that individuals with a first-degree relative diagnosed with sporadic CRC or adenomas before the age of 60 or with multiple first-degree relatives diagnosed with CRC or adenomas undergo colonoscopic screening. Colonoscopy is recommended every 3-5 years beginning at an age 10 years younger than the age of the youngest affected relative\(^19\). There is no direct evidence regarding the initiation or appropriate interval of surveillance in these patients.

**PERSONAL HISTORY OF COLORECTAL CANCER**

Patients with a personal history of colorectal cancer are at increased risk for a metachronous cancer as well as at risk for recurrence of the index cancer. These individuals should undergo a preoperative colonoscopic examination if possible. If this is not feasible, a complete postoperative examination should be performed within 1 year of resection. If either of these examinations is normal, then a subsequent examination may be performed at 3-6 years.

**PERSONAL HISTORY OF ADENOMAS**

Colonoscopy is the preferred method of post-polypectomy follow-up. In addition to being the most sensitive method of polyp detection, it permits the removal of most recurrent polyps.

The optimal interval for follow-up colonoscopy after clearance of the colon appears to be 3 years. The National Polyp Study found that patients randomized to undergo post-polypectomy surveillance at 1 and 3 years versus 3 years only showed no difference in the frequency of detection of polyps with advanced pathology\(^31\). The recommended interval for subsequent colonoscopic surveillance depends upon the number and type of polyps seen on the initial follow-up examination. Most experts recommend that surveillance intervals be tailored according to the type of polyps removed on colonoscopy. Individuals with high risk lesions such as polyps that are ≥1 cm and/or have villous architecture should have more frequent surveillance than individuals with small, tubular adenomas. These intervals should be individualized.

**MANAGEMENT OF POLYPS**

Most polyps seen during colonoscopy can be completely removed by electrocautery. The safety of this procedure has been substantiated by the low incidence of complications reported in numerous series\(^32,33,34,35\). The endoscopist should always be prepared to perform a total examination and remove all polyps found at the time of the first colonoscopy, although technical factors encountered during colonoscopy may limit completion of the procedure. Every effort should be made to avoid repetitive procedures.

The finding of a neoplastic polyp > 1 cm by rigid or flexible sigmoidoscopy is an indication for examination of the entire colon, since 30-50% of such patients will harbor additional polyps. Controversy

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**Table 2. Screening recommendations for individuals with significant family history**

<table>
<thead>
<tr>
<th>Family History</th>
<th>Screening Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>FAP with positive genetic test proband</td>
<td>Offer genetic testing with counseling; if positive, annual FS beginning at age 10-12 years with colectomy when polyps develop. If no polyps annual FS to age 40, then every 3-5 years after.</td>
</tr>
<tr>
<td>FAP with negative genetic test proband</td>
<td>FS in all potentially affected relatives as performed above.</td>
</tr>
<tr>
<td>HNPCC</td>
<td>Colonoscopy every 2 years beginning at age 25, or 5 years younger than the earliest age of diagnosis of CRC, whichever is earlier. Annual screening after age 40.</td>
</tr>
<tr>
<td>First degree relatives with sporadic CRC or adenomas prior to age 60 or multiple first degree relatives with CRC or adenomas</td>
<td>Colonoscopy every 3-5 years beginning at an age 10 years younger than the age at diagnosis of the youngest affected relative.</td>
</tr>
</tbody>
</table>

**Table 3. Surveillance recommendations for individuals with significant personal history**

<table>
<thead>
<tr>
<th>Personal History</th>
<th>Surveillance Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prior CRC clearance of the remainder of the colon at or around the time of resection, followed by colonoscopy at 3 years after curative resection, then at 3-6 year intervals to detect metachronous neoplasia.</td>
<td>clearance of the remainder of the colon at or around the time of resection, followed by colonoscopy at 3 years after curative resection, then at 3-6 year intervals to detect metachronous neoplasia.</td>
</tr>
<tr>
<td>Prior colon adenomas</td>
<td>After adequate clearance, surveillance colonoscopy at 3-6 year intervals.</td>
</tr>
<tr>
<td>Ulcerative pancolitis / Cronh's pancolitis of 8 years' duration</td>
<td>Surveillance colonoscopy every 1-3 years with systematic biopsies to detect dysplasia.</td>
</tr>
<tr>
<td>Left sided colitis of &gt; 15 years' duration</td>
<td>Surveillance colonoscopy every 1-3 years with systematic biopsies to detect dysplasia.</td>
</tr>
</tbody>
</table>
remains over whether colonoscopy is indicated in patients with polyp(s) < 1 cm found on sigmoidoscopy. A Mayo Clinic study showed that patients with distal polyps < 1 cm were at no greater cancer risk than the general population. However, these polyps were fulgurated, so their histology was unknown. A study from St. Marks Hospital in London found no increased cancer risk in individuals with a single <1 cm tubular adenoma. A recent Lahey Clinic study found advanced neoplasms (size > 1 cm and/or tubulovillous or carcinomatous histology) in 6% of those with diminutive (1-5 mm) and 10% of individuals with small (6-10 mm) distal polyps. A fourth study found that individuals with a single distal diminutive tubular adenoma had a low prevalence of advanced proximal polyps (0%; 95% CI, 0-4%). Because the aforementioned data are conflicting and the various study designs potentially flawed, the decisions to perform colonoscopy on these patients should be individualized.

Biopsy-proven inflammatory colorectal polyps are not related to cancer. It is not clear whether individuals with hyperplastic polyps have an associated incidence of adenomatous polyps higher than that of control subjects without hyperplastic polyps. Colonoscopy is the preferred method of examination of the colon following a flexible sigmoidoscopy with at least one tubular adenoma because it allows both detection and removal of synchronous polyps.

The morbidity, mortality and cost of colonoscopic polypectomy are significantly less than those for polypectomy by laparotomy. The latter is justified only when an experienced endoscopist is unable to remove the entire lesion safely.

Although controversy still exists regarding the degree of malignant potential of polypoid lesions of the colon, current opinion is that most cancers arise in preexisting neoplastic polyps. It is impossible to tell grossly which lesions are or will become malignant. The incidence of malignancy in a polyp rises as the size and villous component of the polyp increase. Because malignant changes in polyps are frequently missed by single and even multiple forcers, histologic evaluation should be based on examination of the completely excised polyp. In general, all polypoid lesions greater than 1 cm in diameter should be totally excised and recovered for histologic examination. The decision to perform colonoscopy for the purpose of removing polyps less than 1 cm in diameter is controversial and should be individualized. Depending on the patient’s age, past history, family history and the presence of other diseases, colonoscopic polypectomy may be recommended for removal of these small lesions. Although occurrence of carcinoma in a lesion under 0.5 cm is rare, it is reasonable to destroy or remove all such diminutive lesions as they are encountered at the time of colonoscopy for any indication. Representative biopsy samples may be obtained when these lesions are too numerous for all of them to be removed.

Large sessile polyps have a high malignant potential and tend to have microscopic foci of residual polyp after excision. Therefore, a patient who has colonoscopic excision of these lesions should have repeat evaluation of the polyp site within 6 months to document complete removal. If residual polyp tissue is found, it should be removed if possible and the completeness of excision checked once again within another 6-month period. If complete removal of the lesion has been verified at the first or second follow-up interval, then subsequent surveillance colonoscopy should be individualized. If, however, a large benign-appearing sessile polyp cannot be completely or safely removed endoscopically within 1-3 examinations, then subsequent bowel resection is indicated.

Patients with adenomatous polyps exhibiting severe dysplasia or carcinoma superficial to the muscularis mucosae can be followed after polypectomy in the same manner as patients with polyps without these features. The management of patients with pedunculated adenomas exhibiting carcinoma extending through the muscularis mucosae (invasive carcinoma) is controversial and must be individualized depending upon the operative risk category of the patient. The risk of lymph node spread is less than the risk of colonic surgery in most patients with malignant, pedunculated polyps provided that the polyp has been completely resected completely, and adequately processed, and there is no histologic evidence of high-grade carcinoma, vascular or lymphatic invasion, or involvement of the margin of the resection. Resection of the involved segment of the colon is recommended when these criteria are not met and may also be justified in selected younger, good-risk patients. Patients with a sessile polyp in which carcinoma has penetrated the muscularis mucosae should usually undergo surgical resection unless contraindicated by the condition of the patient.

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