

**POTENTIAL, EXPECTATIONS, AND PROBLEMS IN CT COLOGRAPHY:  
A COLONOSCOPIST'S PERSPECTIVE**

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## **Introduction**

Virtual colonoscopy (CT colography) is a very promising new technique for examining the colon and rectum that combines rapid spiral CT scanning of the abdomen with advanced computer programs capable of rendering two- and three-dimensional views of the large bowel. Since its introduction by Vining in 1994, this very promising, indirect method of imaging the large bowel has undergone rapid improvement (1). Some radiologists now contend that virtual colonoscopy has reached a stage in its development where it can be offered as an option for colorectal cancer screening. In this article, I will discuss the potential of virtual colonoscopy as

a screening test for colorectal neoplasia and will suggest some issues and problems that I believe radiologists still need to address before it can be promoted for general population-based screening of the average-risk population.

#### **Guideline recommendations for colorectal cancer screening**

Current evidence-based guidelines developed in the U.S. now recommend that all asymptomatic, average risk people in high-incidence countries be offered screening for colorectal cancer (2,3). After age 50, annual fecal occult blood tests (FOBT) plus flexible sigmoidoscopy every five years are the preferred recommendations. Scientific studies and clinical experience indicate that widespread adoption of these recommendations could reduce the mortality from colorectal cancer by over half. The guidelines also include the options of direct screening with a double-contrast barium enema every five years or a direct colonoscopy every ten years, although these two approaches are supported at this time only by indirect evidence. According to these guidelines, in order for a new test such as CT colography to replace established screening methods, it first should be shown to be as safe, acceptable, available, effective, and cost-effective as the method it is replacing.

#### **Advantages and limitations of CT colography**

Virtual colonoscopy already has been shown in several comparison studies to be more accurate than barium enema for detecting colorectal polyps (4,5). In addition, some studies indicate that this method is nearly as accurate as colonoscopy for detecting advanced ( $\geq 1$  cm) polypoid adenomas, although accuracy rapidly drops off for smaller polyps. As a practicing colonoscopist, I see that virtual colonoscopy has several obvious advantages over conventional colonoscopy. Examination time is shorter and there is no need for IV conscious sedation. The procedure is safer--to date there have been few, if any, reported complications. The technique allows scrutiny of both sides of the bowel wall and of bowel folds. Very precise localization of abnormalities is possible, and the method can examine the proximal colon for synchronous neoplasia before surgery when a left-sided cancer prevents passage of a colonoscope.

Disadvantages of virtual colonoscopy include the need for a very thorough bowel cleansing preparation and for somewhat uncomfortable gas distention of the colon. Spasm of colonic segments or retained fluid or stool greatly interfere with the accurate interpretation of studies. Some centers report a relatively long learning curve to set up and read these scans, and reading still requires appreciable, expensive radiologist time. Several studies indicate a relatively low sensitivity for detecting flat, sessile lesions, and there are many false-positive scans. Lastly, unlike conventional colonoscopy, virtual colonoscopy is a diagnostic test only. Whenever a significant neoplasm is detected, the patient must undergo a conventional colonoscopy to biopsy or resect the lesion.

#### **Cost and cost-effectiveness of virtual colonoscopy screening**

The first major issue that radiologists need to address has to do with the charges and true costs of virtual colonoscopy. If the indication for an examination is screening or surveillance for colorectal neoplasia of asymptomatic people, additional colonoscopies often will be needed to assess findings or remove polyps. In these cases, a much more cost-effective approach may be to do an initial colonoscopy and take care of diagnosis and treatment in a single sitting with a single bowel preparation. In the U.S., the current charges for virtual colonoscopy are about five times greater than for that of a barium enema and they approach the charge for direct colonoscopy. It seems obvious that the price of a screening virtual colonoscopy would have to drop substantially below that of conventional colonoscopy in order to not dramatically increase the overall cost of screening. Currently, most health care payers are likely to favor screening with direct colonoscopy. Further advances in automated reading of CT scans could decrease the cost of virtual colonoscopy to a level that would allow it to compete on a cost-effectiveness basis, with established screening methods. Radiologists probably will need to establish a special screening charge that is substantially less than the current charge for a conventional abdominal-pelvic CT scan. With the new super rapid multihead CT scanners, high volume through-put of patients and other economies of scale may help to make this economically possible.

A recent mathematical, cost-effectiveness analysis emphasizes this point. Sonnenberg et al used a Markov modeling method to compare the cost-effectiveness of virtual colonoscopy with that of conventional

colonoscopy for screening for colorectal cancer in the U.S. (6). This analysis showed that virtual colonoscopy was more costly than colonoscopy—\$24,586 vs. \$20,930 (U.S.) per year of life saved. A very interesting observation was that even when these authors assumed that the sensitivity and specificity of virtual colonoscopy was 100%, conventional colonoscopy remained more cost effective. Only when the cost of virtual colonoscopy was assumed to be <55% that of conventional colonoscopy, or the compliance rate for virtual colonoscopy screening was assumed to be 15%-20% higher than for colonoscopy, did virtual colonoscopy become the more cost-effective option.

#### **Compliance with screening recommendations**

Whether we are considering standard screening with FOBT and flexible sigmoidoscopy, direct colonoscopy, or virtual colonoscopy, compliance (patient acceptance) is a key issue. Even if we have a sensitive and specific screening test, accurate diagnostic studies, and effective treatment, the final critical, weak link in a successful screening program is compliance. If compliance is low, the most effective screening method—even direct colonoscopy—will not appreciably improve morbidity or mortality from colorectal cancer. This is where virtual colonoscopy both has some problems and some potential advantages over other established screening options. There is no question that the public is strongly attracted to the concept of a “virtual” test that does not require intubation of the colon. However, when people learn that they first must go through a vigorous bowel cleansing preparation and then undergo rectal intubation and distention of their large bowel with gas, their acceptance of this method substantially decreases. Akerkar and colleagues in California conducted a satisfaction survey of 295 patients who underwent both conventional and virtual colonoscopy (7). Both immediately after, and 24 hours later, these patients generally rated virtual colonoscopy lower in acceptability with regard to pain, discomfort, and personal embarrassment. When specifically asked if they would be willing to repeat either examination, they preferred conventional to virtual colonoscopy.

Therefore, another important issue that needs to be addressed if virtual colonoscopy is to play a major role in population-based screening is the development of a better-tolerated bowel cleansing preparation and better-tolerated methods of achieving necessary colonic distention. If a way can be found to do virtual colonoscopy without a preparation—by tagging or marking stool so that the computer can separate retained lumen contents from tissue (a “virtual” preparation), there’s no question but that virtual colonoscopy quickly would become the preferred screening method for many people.

#### **Polyp cut-off size and screening intervals**

Two other separate, but closely related issues that need to be addressed are the frequency or interval of screening virtual colonoscopy, and what polyp cut-off size will be considered adequate for a screening examination. Radiologists correctly have stressed that an imaging method that detects larger polyps but misses some small ones, might nevertheless be an effective screening option, especially if it is repeated at appropriate intervals. Most small polyps are slowly growing, clinically unimportant lesions because they are tubular adenomas that will never develop the additional genetic alterations that would cause them to grow and become malignant. Most gastroenterologists now agree that missing diminutive polyps—those 5 mm or less in size—has little clinical importance, and our most important screening objective is to reliably detect more advanced adenomas that are much more likely to turn to cancer (8). Currently however, the controversial area has to do with polyps of intermediate size (5-9 mm). In the short run, such polyps pose a low cancer risk. However most clinicians and patients today may be unwilling to have such lesions missed by a screening virtual colonoscopy unless they know that a repeat screen will be done within 3-5 years. Increasing the frequency of screening, however, greatly increases the cost of a screening program. If virtual colonoscopy needs to be repeated that often to be protective, it again may not compete well with direct colonoscopy screening that currently is recommended by the guidelines only every 10 years.

#### **Summary and conclusions**

It appears that CT colography (virtual colonoscopy) has a very bright future. However, in addition to addressing the screening issues discussed here—cost, cost-effectiveness, acceptance or compliance, accuracy for intermediate-sized polyps, and interval of screening—a number of technical refinements or advances yet are

needed. These include the continued introduction of the latest generation of rapid CT scanners in more centers, better computer software and greater radiology experience leading to improved accuracy and shorter reading times, new methods for detecting flat sessile adenomas, better bowel preparation and distention methods (or contrast methodology that will obviate the need for a bowel preparation), and availability in more centers. Once these issues and problems have been adequately addressed and solved, the addition of virtual colonoscopy as a screening option should improve screening compliance and favorably impact outcome from this important deadly disease.

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