

Motion – Computerized tomographic colography is a better method for screening for polyps: Arguments for the motion

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BC Pineau. Motion – Computerized tomographic colography is a better method for screening for polyps: Arguments for the motion. Can J Gastroenterol 2003;17(2):125-128.

Colorectal cancer is an important public health problem that is amenable to prevention and early treatment. Traditional screening techniques – fecal occult blood testing, flexible sigmoidoscopy, barium enema and colonoscopy – each have limitations in terms of diagnostic accuracy, cost and/or patient acceptability. Compliance with recommendations for screening has been poor, in part, because of negative perceptions about the available modalities. Virtual colonoscopy, or computerized tomographic colography, is a minimally invasive technique that safely evaluates the entire colon and does not require sedation. Thorough cleansing as well as immobilization and air insufflation of the colon is crucial to a successful examination. Sensitivity and specificity rates are reasonable, compared with conventional colonoscopy, and it has been shown that the latter technique can be averted in over two-thirds of cases, with few false-negative examinations. Most patients find virtual colonoscopy more acceptable than the conventional technique, and would prefer it if a repeat procedure were warranted. An economic analysis that found that computerized tomographic colography was less cost effective than conventional colonoscopy did not consider the indirect costs of the latter, which is an important limitation. Virtual colonoscopy is a novel radiological technique that may revolutionize screening for colorectal cancer.

Key Words: *Colorectal cancer; Colorectal polyps; CT colography; Screening; Virtual colonoscopy*

Colorectal cancer (CRC) is a major public health concern (1). The colon and rectum is the fourth most common site of new cancers, with 148,300 incident cases in the United States in 2002. There is a 5% lifetime risk of developing this tumour. CRC is second only to lung cancer as a cause of cancer-related mortality, with 56,600 deaths in the United States in 2002. Decreases in colon and rectum cancer incidence and mortality rates began in the mid-1980s and have continued to decline by an annual average of 1.6% and 1.8% respectively (2). Although the reasons for the decline in mortality are not entirely clear, possible explanations include a decreased incidence of CRC, improved polyp detection and removal, earlier and more accurate diagnosis and improved outcomes from medical and surgical therapies.

Motion – La colographie par tomodensitométrie est une meilleure méthode de dépistage des polypes : Arguments en faveur de la motion

Le cancer colorectal est un problème de santé publique important qui peut être prévenu et faire l'objet d'un traitement précoce. Les techniques traditionnelles de dépistage (dépistage de sang occulte dans les selles, sigmoïdofibroscope, lavement baryté et coloscopie) ont chacune leurs limites pour ce qui est de la précision diagnostique, du coût ou de l'acceptabilité par le patient. Le respect des recommandations de dépistage est faible, en partie à cause des perceptions négatives relativement aux modalités offertes. La coloscopie virtuelle, ou coloscopie par tomographie par ordinateur, est une technique très peu effractive qui évalue tout le côlon de manière sûre, sans sédation. Un nettoyage minutieux, l'immobilisation et l'insufflation d'air dans le côlon sont des éléments essentiels à la réussite de l'examen. Le taux de sensibilité et de spécificité est raisonnable par rapport à celui de la coloscopie traditionnelle, et il a été démontré que cette technique peut être évitée dans plus des deux tiers des cas, tout en suscitant peu de faux résultats positifs. La plupart des patients trouvent la coloscopie virtuelle plus acceptable que la technique traditionnelle et préféreraient qu'une intervention répétée soit nécessaire. Une analyse économique selon laquelle la coloscopie par tomographie par ordinateur était moins rentable que la coloscopie traditionnelle ne tenait pas compte des coûts indirects de cette dernière intervention, lesquels constituent pourtant une limite importante. Ainsi, la coloscopie virtuelle est une nouvelle technique radiologique qui pourrait révolutionner le dépistage du cancer colorectal.

SCREENING

The biological behavior of CRC lends it to early detection and prevention, which presents an opportunity to substantially decrease the burden of the disease. To this end, most efforts have concentrated on detecting CRC at an early, localized stage, for which the five-year survival approaches 90% (3). Because screening tests can also identify adenomatous polyp precursor lesions, widespread use of these procedures could dramatically decrease cancer incidence.

Current strategies

The main goal is the detection of polyps and early cancers. The available screening modalities include digital rectal examina-

This article was originally presented at a symposium entitled, "Controversies in Gastroenterology", sponsored by Axcan Pharma, Toronto, Ontario, April 8 to 10, 2002

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tion, fecal occult blood testing (FOBT), flexible sigmoidoscopy, barium x-rays of the colon and colonoscopy, which is the 'gold standard' examination.

Although FOBT is safe and noninvasive, it is limited by its ability to detect reliably only cancers and not premalignant polyps (4). However, in combination with colonoscopic evaluation of patients with positive tests, FOBT is shown to decrease mortality by one third during a 13-year follow-up (4).

Flexible sigmoidoscopy allows visualization of less than half of the surface of the colon. Its effectiveness in decreasing the incidence and mortality of CRC has been demonstrated by several case-control studies (5-7) and a prospective observational study (8). One-time screening with FOBT and sigmoidoscopy misses 24% of advanced adenomas (as defined by a diameter of greater than 1 cm, villous histology or the presence of high grade dysplasia) or cancers (9). Moreover, sigmoidoscopy alone misses advanced adenomas in 52% of patients in whom such lesions were detected by colonoscopy (10).

Barium enema and colonoscopy allow visualization of the entire colon. Although the former technique is safer, its performance characteristics in the National Polyp Study were disappointing (11). Barium enema yielded poor sensitivities in detecting lesions of 6 mm to 9 mm (53%) or greater than 1 cm in diameter (48%). Such results raise serious concerns about its suitability as a screening modality.

Because it allows direct visualization of the mucosa, colonoscopy is more sensitive and specific than other techniques. Moreover, it is possible to remove polyps. However, even experts can miss polyps at colonoscopy. Up to 24% of adenomas can be missed, including 6% of polyps greater than 1 cm in diameter and 13% of those 6 mm to 9 mm in diameter (12). In clinical practice, colonoscopy misses 5% of colorectal cancers, compared with 17% missed by barium enema (13). In addition, colonoscopy causes serious bleeding or colonic perforation in 0.15% to 0.2% of examinations (14). Its limitations as a screening test involve high cost, patient acceptability and risk of complications.

Barriers to screening

Based on 1999 data from the Behavioral Risk Factor Surveillance System, fewer than 20% of adults over the age of 50 years reported having a FOBT within the previous year, and only 32% reported having undergone either flexible sigmoidoscopy or colonoscopy within the preceding five years (15). Moreover, only 959 of 17,000 health care professionals or their spouses responded to an invitation to undergo free colonoscopic screening (16). The poor compliance with sigmoidoscopy screening recommendations has been attributed to conflicts with work or family, inconvenience, cost and concerns about pain and complications (17). These factors are likely to be even more pronounced for colonoscopy than for flexible sigmoidoscopy, and provide impediments to screening programs.

Future strategies

The ideal technique for screening of the general population would have a high sensitivity and specificity for detecting colorectal polyps, be inexpensive and safe, and be associated with minimal patient discomfort. It should adequately evaluate the

entire colon. Approximately half of all colorectal cancers are proximal to the splenic flexure and cannot be detected at flexible sigmoidoscopy (18). Furthermore, there is evidence suggesting that adenomas and carcinomas occur more proximally in black American subjects than in the white population (19).

VIRTUAL COLONOSCOPY

Virtual colonoscopy is a novel imaging modality for the detection of colonic polyps and cancers. Because it is minimally invasive, it has the potential to revolutionize CRC screening. The procedure involves thorough cleansing, followed by air insufflation of the colon, before scanning of the abdomen and pelvis with helical computerized tomography (CT). Using the CT image data (CT colography) and virtual reality computer technology, a series of three-dimensional images of the colon can be generated in rapid sequence and interpreted by the radiologist. Unlike conventional colonoscopy, virtual colonoscopy does not require conscious sedation and has no reported complications, which makes it attractive as a screening test.

Proper bowel preparation is considered critical to the success of virtual colonoscopy (20-22). It consists of cleansing, immobilization and distension of the colon. Oral contrast agents may improve the detection of lesions and the ability to distinguish tumours from residual stool, but their benefits remain unproven (21,23).

Since first reported by Vining et al (24) in 1994, this technique has been compared with conventional colonoscopy by several investigators (25-29). Its sensitivity for lesions of at least 1 cm in diameter ranges from 50% to 91%. The sensitivity and specificity for identifying patients with lesions of this size is 62% to 100% and 74% to 96%, respectively (Tables 1 and 2). Virtual colonoscopy has a very high negative predictive value, thereby reducing the need for conventional colonoscopy. A study performed at Wake Forest University found that virtual colonoscopy prevented 86% of colonoscopies, at a cost of 1% false-negative examinations when the lesion of interest was at least 1 cm in diameter. For lesions 6 mm in diameter, virtual colonoscopy prevented 68% of negative colonoscopies, at a cost of 3% false-negative tests. These data indicate that this technique may be suitable for screening average risk individuals with a low prevalence of disease. The accuracy of virtual colonoscopy is directly proportional to the size of the lesion of interest. The size at which lesions become clinically significant remains a matter of debate.

PREFERENCE

Patient preference is an important issue for CRC screening. Comparisons of virtual and conventional colonoscopy have yielded conflicting results (30-33).

Akerkar et al (30) concluded that patients tolerated conventional colonoscopy better than CT colography, but their study was subject to several limitations (33). For example, colonic distention was achieved with air insufflation using a hand-bulb technique to 'maximum patient tolerance' as opposed to controlled low pressure electronic insufflation with carbon dioxide. As well, patient assessment of tolerance data that were captured immediately after virtual colonoscopy (presedation) did not appear to differ significantly from the

TABLE 1
Published studies of detection of lesions at virtual colonoscopy

Reference	Patients (N)	Lesions (N)	1 to 5 mm %	Sensitivity 6 to 9 mm %	≥10 mm % (N)
Hara, 1996 (32)	10	30	28	71	100 (5)
Hara, 1997 (24)	70	161	27	69	73 (15)
Rex, 1999 (26)	46	91	11	43	50 (14)
Fenlon, 1999 (25)	100	118	55	82	92 (25)
Pescatore, 2000 (27)	50	65	–	–	–
Fletcher, 2000 (22)	180	420	–	47	75 (121)
Kay, 2000 (33)	38	24	–	39	91 (11)
Yee, 2001 (28)	300	524	59	80	91 (90)

TABLE 2
Published studies of identification of patients with lesions at virtual colonoscopy

Reference	Patients (n)	6 to 9 mm		≥10 mm	
		Sens (%)	Spec (%)	Sens (%)	Spec (%)
Hara, 1996 (32)	10	–	–	–	–
Hara, 1997 (24)	70	63	66	75	90
Rex, 1999 (26)	46	43	–	80	–
Fenlon, 1999 (25)	100	94	92	96	96
Pescatore, 2000 (27)	50	–	–	62	74
Fletcher, 2000 (22)	180	88	–	85	85
Kay, 2000 (33)	38	67	75	90	82
Yee, 2001 (28)	300	93	–	100	–

Sens Sensitivity; Spec Specificity

results of the conventional colonoscopy assessment, yet this analysis was not performed. This result could possibly be explained by a difference in pretest perception between these two modalities that favours virtual colonoscopy. A study assessing this in potential patients who had not undergone any testing showed that virtual colonoscopy was significantly favoured over conventional colonoscopy (31).

Preliminary data from our evaluation of patient preference revealed that, before undergoing either evaluation, virtual colonoscopy was also better perceived or accepted than conventional colonoscopy (32). After undergoing the procedure, however, the patients regarded both tests equally. This change was primarily due to significant improvement in patient perception or acceptance for conventional colonoscopy following testing, whereas there was no significant change in this parameter after virtual colonoscopy. Nevertheless, 62% of patients stated that they would prefer to undergo repeat virtual rather than conventional colonoscopy if the tests were clinically necessary and equally accurate. Because it is better perceived and preferred to conventional colonoscopy, CT colography may lead to a significant improvement in compliance with CRC screening recommendations.

COST

A study by Sonnenberg et al (14) compared the cost effectiveness of virtual and conventional colonoscopy for CRC screening programs, using a Markov model. The colonoscopy-based program was more cost effective than that using CT cologra-

phy. However, if initial compliance rates were increased by 15% to 20%, or the cost of the procedure were to drop below US\$336, virtual colonoscopy would become a cost effective technique for CRC screening. Indirect costs associated with conventional colonoscopy, such as time lost from work and the need for a person to accompany the patient, were not considered in the analysis and would result in higher estimated costs of this procedure. Further studies are required to compare costs of these procedures in a screening setting.

CONCLUSIONS

Virtual colonoscopy (CT colography) is a safe, minimally invasive radiological technique that allows the visualization of the entire colon, and that appears to be readily accepted by patients. Its sensitivity increases with the size of the neoplasm of interest, and false-negative examinations are uncommon. Improvements in compliance and reductions in the cost of CT colography would make it a cost effective alternative to conventional colonoscopy. It appears to be more acceptable to patients than is colonoscopy, which may improve compliance with CRC screening programs.

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