The term "evidence-based medicine" was first coined by Sackett and colleagues[1] as "the conscientious, explicit and judicious use of current best evidence in making decisions about the care of individual patients." The key to practicing evidence-based medicine is applying the best current knowledge to decisions in individual patients. Medical knowledge is continually and rapidly expanding and it is impossible for an individual clinician to read all the medical literature. For clinicians to practice evidence-based medicine, they must have the skills to read and interpret the medical literature so that they can determine the validity, reliability, credibility and utility of individual articles. These skills are known as critical appraisal skills. Generally, critical appraisal requires that the clinician have some knowledge of biostatistics, clinical epidemiology, decision analysis and economics as well as clinical knowledge.

The Canadian Association of General Surgeons and the American College of Surgeons jointly sponsors a program entitled "Evidence-Based Reviews in Surgery (EBRS)," supported by an educational grant from Ethicon Inc and Ethicon Endo Surgery Inc. The primary objective of this initiative is to help practicing surgeons improve their critical appraisal skills. During the academic year, eight clinical articles are chosen for review and discussion. They are selected not only for their clinical relevance to general surgeons but also because they cover a spectrum of issues important to surgeons; for example, causation or risk factors for disease, natural history or prognosis of disease, how to quantify disease (measurement issues), diagnostic tests and the diagnosis of disease, and the effectiveness of treatment. Both methodologic and clinical reviews of the article are performed by experts in the relevant areas and posted on the EBRS website. A listserve discussion is held where participants can discuss the monthly article. Fellows and candidates of the College can access Evidence-Based Reviews in Surgery through the American College of Surgeons website (www.facs.org). All journal articles and reviews are available electronically through the website. Currently we have a library of 50 articles and reviews that can be accessed at any time. Each October, a new set of articles will be available each month until May. Surgeons who participate in the current (modules) packages can receive CME credits by completing a series of MCQ. Additional information about EBRS is on the ACS website or by email: Marg McKenzie at mmckenzie@mtsinai.on.ca.

In addition to making the reviews available through the ACS and CAGS websites, four reviews are published in condensed versions in the *Canadian Journal of Surgery* and the other four will be published in the *Journal of the American College of Surgeons* each year.

REFERENCE

1. Evidence-Based Medicine Working Group. Evidence-based medicine. JAMA 1992;268:2420–2425.

SELECTED ARTICLE

Cost-Effectiveness of Computerized Tomographic Colonography versus Colonoscopy for Colorectal Cancer Screening

Heitman SJ, Manns BJ, Hilsden RJ, et al. CMAJ 2005; 173(8):877–881.

Reviewed by

Harry Henteleff, MD; Nancy Baxter, MD; James Church, MD; Linda Rabeneck, MD; Tanya Chawla, MD; for Members of the Evidence Based Reviews in Surgery Group.*

ABSTRACT

Objective: To assess whether CT colonography is more or less cost effective than colonoscopy for colorectal cancer screening in an average risk individual over the age of 50 years.

Design: Cost effectiveness study.

Setting: Calgary Health Region administrative data sets.

Patients: Average-risk individuals over the age of 50 years old.

Intervention: Decision analysis software was used to construct a model comparing CT colonography and colonoscopy. A period of 3 years was chosen for the model based on 3 considerations: 1) risk of cancer after therapeutic colonoscopy (due to lesions missed at baseline); 2) natural history of unresected polyps (≥ 10 mm); and 3) appropriate rescreening interval for CT colonography.

Main Cost and Outcomes Measures: Estimated indirect costs of colonoscopy and CT colonography were $231.12 and $71.04 respectively. Outcomes measures included: 1) number of colonoscopies, perforations, and adenomas removed; 2) deaths from perforations and colorectal cancer from missed adenomas; and 3) direct health care costs.

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Main Results: CT colonography would cost $2.27 million extra per 100,000 patients screened; 3.78 perforation-related deaths would be avoided, but 4.11 extra deaths would occur from missed adenomas.

Conclusion: A population-based screening strategy using CT colonography would be more expensive and lead to more overall deaths from colonoscopy, making colonoscopy the "dominant" strategy.

Commentary: Various options are available to screen individuals for colorectal cancer. But uptake remains poor with quoted statistics for population-based screening, in the range of 15% to 20%. Although screening with fecal occult blood testing has been shown effective in decreasing cancer specific mortality and decreasing colorectal cancer incidence, it has poor sensitivity and so other strategies are being evaluated. Colonoscopy, considered the gold standard both from a diagnostic and therapeutic point of view, is here compared to the newer technique of CT colonography followed by colonoscopy in patients with polyps larger than 5mm. This is therefore a highly topical paper. Economic analyses often make dry reading but are critically important because they can be used to guide policy by paying agencies.

This cost-effectiveness analysis is based on Canadian data during a three year period. The results are measured in cost per lives saved rather than cost per quality adjusted life years (QALYS). A model was constructed comparing CT colonography with colonoscopy for colorectal cancer screening in an average risk patient older than 50 years of age. The authors limited their results to a three year period to provide a snapshot of the current state of the art of both tests. The authors conclude that CT colonography cannot be recommended as a primary means of population-based colorectal cancer screening in Canada.

Cost-effectiveness studies are best done prospectively, which was not the case in this study. As well, they should compare all relevant strategies, look at appropriate populations, measure costs and outcomes accurately, and make allowances for uncertainty in their assumptions.

This study compared only two screening strategies in a general population older than 50 years of age. Other strategies include fecal occult blood testing (the only strategy with Level I evidence supporting it), flexible sigmoidoscopy and barium enema, and fecal DNA testing. Sigmoidoscopy and barium enema is generally considered less effective than colonoscopy but can be cheaper if performed by non-physicians. If fecal DNA testing becomes cheaper and proves to be sensitive in detecting large polyps and cancers, colonoscopy could be reserved for those patients with a positive test and might eliminate the need for barium enema or colonography. Finally, no screening might also be an option.

The cost data were carefully collected and, because the authors are explicit in their collection, the data can be extrapolated to other centres if local costs are available. The authors found that the incremental cost of utilizing CT colonography (compared with colonoscopy first) for colorectal cancer screening in a Canadian population older than 50 years was $2.27 million per 100,000 patients screened. This strategy avoided 3.78 perforation related deaths but resulted in 4.11 extra deaths from malignant progression of missed polyps.

These results were sensitive to test performance characteristics of CT colonography, the malignant risk of missed adenomas, risk of perforation and related death, the procedural costs and differences in screening adherence. The costing data do not include capital costs which is important because there is insufficient capacity in the Canadian system to provide either the increased number of endoscopies or CT colonographies needed for a population-based scale screening program. Also relevant is the fact that CT colonography was only slightly more expensive than colonoscopy in this analysis ($23/person). The relative costs of the two tests might be dramatically different in 5 or 10 years because imaging studies tend to get cheaper once the equipment is installed and running. If CT colonography were significantly cheaper than colonoscopy and more acceptable to patients (which might improve uptake of the test), it could be a more feasible option.

Finally, it is important to consider the cost of repeat screening. The authors state that repeat CT colonography is not likely to be recommended within three years of the first test but do not base this on good evidence. Recommendations for repeat colonoscopy will vary according to the findings at first screening. Any real policy decisions will have to be based on a realistic schedule of ongoing screening such as is used in esophagoscopy for Barrett's esophagus or mammography for breast cancer. The better the first screening test becomes, the less frequent will be the need for repeat testing.

One of the most important issues when reading an article like this one is the accuracy of the data used in the model and the costing. The authors did an extensive search of the best evidence as outlined by their

search strategy. The authors also performed extensive sensitivity analyses varying the sensitivity and specificity of both tests over a wide range as well as looking at complication rates of the procedures. The sensitivity of colonoscopy for detecting polyps is well established but may improve with technologies like high definition cameras and narrow beam imaging. CT colonography will likely improve as computer technology improves and, more importantly, radiologists become more experienced in reading these tests but it is unlikely that the sensitivity will ever be higher than the upper end of the range of values considered by the authors.

This article is a well performed economic analysis comparing two important screening strategies for colorectal cancer. The data were carefully collected and analyzed. The evidence collected by the authors support their conclusion that CT colonography cannot be recommended as a primary means of colorectal cancer screening.

This, however, will not be the final word in evaluating cost-effectiveness of colorectal cancer screening in Canada or elsewhere. These results should not change current practice, screening recommendations, or public policy; the ideal screening program will likely combine both techniques. Patients at low risk of having adenomas (younger, no family history, no past history) may be considered for CT colonography, while conventional colonoscopy may be recommended for those at higher risk so polyps can be removed when seen. Although CT colonography will likely play a major role in colorectal cancer screening in the future, it currently has a complementary role to colonoscopic screening when patients decline colonoscopy or have an incomplete endoscopic examinations.