

The term “evidence-based medicine” was first coined by Sackett and colleagues¹ 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 of 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 sponsor 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 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 listserv 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. We have a library of articles and reviews dating back to October 2000, which can be accessed at any time. Each October a new set of articles and reviews are available each month until May. Surgeons who participate in the current (modules) packages can receive CME credits by completing a series of MCQ. For further information about EBRS the reader is directed to the ACS website or should email the administrator, Marg McKenzie at mmckenzie@mtsinai.on.ca.

In addition to making the reviews available through the ACS and CAGS websites, 4 of the 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

The Evaluation of Rectal Bleeding in Adults: A cost-effectiveness Analysis Comparing Four Diagnostic Strategies

Allen E, Nicolaidis C, Helfand M. *J Gen Intern Med* 2005;20:81–90.

Reviewed by

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ABSTRACT

Objective: To compare the cost effectiveness of four diagnostic strategies in the evaluation of rectal bleeding.

Design: Cost-effectiveness analysis using a Markov decision model.

Base Case: A 55 year old patient presenting with one or more episodes of rectal bleeding (defined as blood on toilet

paper, in toilet bowl, mixed in stool or on stool) who is otherwise asymptomatic and has no personal or family history of colorectal cancer (CRC).

Treatment Alternatives: Watchful waiting (WW), flexible sigmoidoscopy (FS), flexible sigmoidoscopy and barium enema (FS+ACBE), and colonoscopy.

Outcomes Considered: Incremental cost-effectiveness ratio.

Sources of Estimates for Probabilities and Utilities:

Baseline probabilities were generated from 6 prospective studies of patients over the age of 40 with rectal bleeding. Utilities were derived from quality of life estimates for patients who had previously undergone resection for a colorectal polyp cancer and inflammatory bowel disease.

Results: FS was the least expensive strategy. Colonoscopy was the most effective strategy with an incremental cost of \$5,480 per quality adjusted year of life saved

(QALY) compared to FS. WW and FS+ACBE were more expensive and less effective than colonoscopy.

Conclusion: Colonoscopy is a cost-effective method to evaluate otherwise asymptomatic rectal bleeding, with low cost per QALY compared to other strategies.

Commentary: Rectal bleeding is a common reason for patients to seek advice from their family doctor and also for referral for surgical assessment. Although the etiology in most cases is a benign condition, rectal bleeding may be the presenting symptom for significant diseases such as colorectal cancer (CRC) and inflammatory bowel disease. As noted by the authors the characteristics of rectal bleeding do not reliably predict the presence or absence of CRC. Age is an important predictor as the risk of CRC increases with age and patients over age 50 years are at particular risk. Thus further investigation is warranted in most patients but especially those over the age of fifty.

There are various investigations that can be used to assess patients with rectal bleeding including rigid sigmoidoscopy, flexible sigmoidoscopy, barium enema, CT colonography and colonoscopy. If health care resources were unlimited, colonoscopy would be the preferred diagnostic modality for all patients. Colonoscopy allows for not only a complete examination of the colon and rectum, but also an opportunity for therapeutic intervention with complete removal of polyps and tissue diagnosis for any identified abnormalities. It can thus help to distinguish between colon cancer and adenomatous polyps. It can also be used when other tests, notably flexible sigmoidoscopy or air contrast barium enema identify an abnormality or are incomplete. Furthermore, failure to identify a cause for the rectal bleeding during flexible sigmoidoscopy should prompt a complete colonoscopic evaluation of the remainder of the colon. However, health care resources are not unlimited, and therefore the economic evaluation of diagnostic strategies for rectal bleeding is an important one. Furthermore, although it is tempting to subject everyone with rectal bleeding to colonoscopy, it is a test that is operator dependent, has the potential for serious complications, such as colonic perforation, and is relatively expensive. Therefore it is important to consider not only the effectiveness of the diagnostic examinations in terms of lives saved, but also to optimize the resultant economic burden.

Allen and associates assessed the cost-effectiveness of four possible strategies for investigating rectal bleeding: watchful waiting, flexible sigmoidoscopy, flexible sigmoidoscopy plus air contrast barium enema and colonoscopy. CT colonography might have been considered but likely was not because it is not widely available. The authors developed a Markov decision model to simulate the natural

history of patients with rectal bleeding. The base case consisted of a 55 year old patient who presented with one or more episodes of bright red blood on the toilet paper, mixed in the stool or in the toilet water. The patient was asymptomatic and had no personal or family history of colon cancer or polyps. The time horizon was the patient's lifetime so patients cycled through the model until they died from either colonic pathology or other causes. For each test strategy, the rate of positive and negative tests, as well as the sensitivity and specificity of the tests, were taken into account in the model. Various assumptions were made including time frame for polyps to advance to cancer and the likelihood of recurrent rectal bleeding necessitating further investigation.

Point estimates and ranges for their probabilities were derived from a systematic review. When possible, point estimates were based on pooled data. When pooling was not possible, an expert review panel estimated base case probabilities. Utilities for various disease states were derived from various sources. Costs were considered from a societal view with costs derived from US sources.

After completing the initial cost-effectiveness analysis for each of the strategies based on the best estimate for each of the probability and utility variables, the authors repeated the calculations using every plausible value from the existing evidence. This process, known as univariate sensitivity analysis, can determine whether the results of the analysis are highly dependent on one particular factor. A two-way sensitivity analysis determines whether simultaneous changes to two variables changes the results of the analysis, were also performed.

The authors found that for the base case scenario, the least expensive strategy was flexible sigmoidoscopy, but colonoscopy offered the greatest life expectancy. The incremental cost-effectiveness of colonoscopy compared to FS was \$5,480. The other two strategies, watchful waiting and FS+ACBE, were both more expensive and had lower life expectancy than colonoscopy.

Varying the utility values in the sensitivity analysis did not change the outcome suggesting that patients' values do not affect outcome. On the other hand, changing the prevalence of IBD (>20%), increasing the risk of colonoscopic perforation (>2%) and hemorrhage (>4%) and increasing the sensitivity of FS for detecting polyps (>98%) did change the results. However, most clinicians would agree that these values are not within the range of accepted values or rates, meaning that within clinically meaningful values, colonoscopy will always be less than \$10,000 more expensive than FS.

Based on their results, the authors concluded that colonoscopy is a cost-effective method to evaluate other-

wise asymptomatic rectal bleeding, with a relatively low cost per QALY compared to other strategies despite the fact that their model showed that flexible sigmoidoscopy is more cost effective. Their point, however, is valid. Colonoscopy was more effective, resulting in more QALYs gained, at a small incremental cost so it is not unreasonable to conclude that colonoscopy is therefore the most desirable strategy.

Interestingly, the authors found that colonoscopy was the most cost-effective strategy for evaluating rectal bleeding in patients age 40–49. Patients with rectal bleeding in this age group typically generate some degree of anxiety in the examining surgeon. This reflects the fact that some of these patients will have CRC but performing a colonoscopy on all of these patients seems excessive as the overwhelming majority of patients will have a benign cause for their bleeding. As well, it might result in excessive demand for colonoscopy in a system where there are limited resources. They suggest that colonoscopy is the most cost-effective strategy for patients age 40–49 with rectal bleeding because of the greater potential for years of life saved due to their greater life expectancy. However, it would appear that the Markov model assumes that all adenomatous polyps ultimately progress to CRC. This is clearly not the case and only a minority of adenomatous polyps develops into CRC. Thus routine colonoscopy in patients age 40–49 with rectal bleeding may not be as beneficial as the authors suggest. Further research is needed to determine the optimal strategy for investigating patients with rectal bleeding in this age group.

In conclusion, currently colonoscopy is used increasingly to evaluate rectal bleeding despite limitations of this

resource in health care systems. The demonstration that colonoscopy is not only effective in diagnosing causes of rectal bleeding, but is also cost-effective, with only a small incremental cost over flexible sigmoidoscopy, has broad-reaching implications. These findings add to the existing body of literature regarding the cost-effectiveness of screening for colorectal cancer and should direct clinicians during the workup of rectal bleeding.

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