DIAGNOSTIC REVIEW

Colonoscopy in screening and diagnosis of colorectal cancer

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INTRODUCTION

Colonoscopy is an endoscopic tool used for the visualization and biopsy of the large intestine with important applications in the investigation of colorectal cancers. Colonoscopy has been used to diagnose colorectal cancer since the late nineteen sixties, and is currently the gold standard. However, colonoscopy is not without shortcomings and attempts have been made to improve this technique. This paper will briefly review the history of colonoscopy, its current applications, and the limitations of colonoscopy for the diagnosis and screening of colon cancer. It will lastly examine innovations in colonoscopy and the advantages they might offer.

HISTORY OF COLONOSCOPY

Dr. William Wolff, and Dr. Hiromi Shinya, pioneered the development of the colonoscope. Their invention, in 1969, was an advance over the barium enema and the flexible sigmoidoscope because it allowed for the visualization and removal of polyps from the entire large intestine. Wolff and Shinya advocated for their invention and published much of the early evidence needed to overcome skepticism about the device’s safety and efficacy. Once the basic technology of the colonoscope had been accepted, the device lent itself to adaptations that have bettered its performance, and broadened its applications. The use of colonoscopy to screen and diagnose colorectal cancer continues to rise. Ultimately, the significance of the test has been to permit an understanding of colorectal cancer through the collection of biopsies, and to lower mortality through screening and diagnosis.

COLORECTAL CANCER AND COLONOSCOPY: CURRENT INDICATIONS

Colonoscopy is the second most common cause of death from cancer among both Canadian men and women; an estimated 22,000 cases were diagnosed in 2011. Most colon cancers begin as small protruding growths called polyps. The chance that a polyp will develop into cancer varies from 2% in lesions under 1.5 cm in diameter to approximately 10% in lesions over 2.5 cm in diameter. Premalignant polyps are estimated to progress over a period of approximately 10 years. Early forms of colorectal cancer are amenable to treatment. If the disease is detected in a local stage, the 5 year survival rate is 90 percent. However, if the cancer has spread regionally the survival rate is 68%, and if disease has metastasized the survival rate is only 10%. Unfortunately, most cases of colon cancer are asymptomatic until advanced stages of the disease. Given the long progression time of this form of cancer and the high success rate of early treatment, it is not surprising that screening programs for colorectal cancer have been able to show substantial survival benefits. Colonoscopy has played an important role in these programs.

The current guidelines on the screening of colorectal cancer acknowledge that a wide range of acceptable options exist. For individuals of average risk over 50 years of age, the recommendation is colonoscopy every ten years, flexible sigmoidoscopy (FISG) every five years, or annual fecal occult blood testing (FOBT). Colonoscopy is the recommended screening test for most individuals with increased risk for colorectal cancers. Additionally, colonoscopy is the recommended follow-up procedure for positive FOBT and FISG.

As a screening test, colonoscopy has two distinct advantages compared to other means of screening for colorectal cancer. One advantage is that it can be used to remove polyps from the entire length of the colon, which reduces the incidence of colorectal cancer. Furthermore, colonoscopy provides biopsy samples which screen for patients that are at a higher risk of developing cancers in the future; these patients will benefit from more frequent screening.

LIMITATIONS OF COLONOSCOPY

While colon cancer is a serious disease, the lifetime prevalence is approximately 6% in North America; 94% of patients who are screened with colonoscopy do not benefit from undergoing the procedure. Therefore, despite the obvious potential for colonoscopy to prevent colorectal cancer, it is necessary to examine the discomfort and risk that patients are exposed to, the limitations in sensitivity, and the costs of colonoscopy.

Patients undergoing colonoscopy require moderate sedation and dietary bowel preparation. The preparation involves consuming a fluid diet and Pico-Salax, a mix of osmotically active and laxative substances. Patients undergoing colonoscopy require moderate sedation and dietary bowel preparation. The preparation involves consuming a fluid diet and Pico-Salax, a mix of osmotically active and laxative substances. Not all patients manage to complete the entire preparation as required and this can decrease test sensitivity as polyps may be missed in stool. Furthermore, a general anesthetic is often required for patients who feel too much pain or discomfort on mild sedation alone. This substantially increases the cost.

As well as discomfort to the patient, undergoing colonoscopy also carries the risk of complication. The most severe complications can be bowel perforation and bleeding, are estimated to occur approximately 1.64 and 0.85 times, respectively, per thousand tests. The rate of complication has also been reported to rise substantially following polypectomy, to approximately 5 per one thousand tests.

When evaluating the test performance of standard colonoscopy, polyps are estimated to be missed at a rate of 27% overall and 6% for adenomas larger than 1 cm. Colonic cancer is also reported to be missed at a rate of 5% with standard colonoscopy. However, there is substantial variation in test characteristics based on the operator.
From a health care system perspective, colonoscopy has significant facility and equipment costs and requires technical expertise to be performed effectively. In Canada, it is estimated to cost $352 per diagnostic procedure, or $467 per therapeutic procedure, when overhead costs and the physician’s fee are included in the estimate. 20

The limitations of colonoscopy must be considered in the context of the primary alternatives. FSIG is an endoscopic technique done with minimal bowel preparation and without sedation. However, FSIG only allows the only distal third of the large bowel to be visualized, making it less sensitive than colonoscopy.6 The FOBT is a less invasive, test for the finding of occult blood in the stool, which is suggestive of colorectal cancers and large polyps. However, the FOBT is significantly less sensitive and specific than colonoscopy. Also, the test characteristics of FOBT vary significantly depending on the brand, collection technique, and number of samples taken per test.8

Although imperfect, colonoscopy does offer improved sensitivity compared to other tests. And while the invasiveness, cost, and risk of complication are frustrating drawbacks, they have not obscured its importance in the screening and diagnosis of colorectal cancers. Rather, they have spurred innovation aimed at modifying standard colonoscopy to address its limitations.

ADVANCED TECHNIQUES

Virtual Colonoscopy

A less invasive alternative to traditional colonoscopy is virtual colonoscopy, also known as CT colonography. A helical CT image is used to create a computer generated 3-dimensional model of the colon. The model can then be visualized digitally for the presence of polyps.19 CT-colonography is non-invasive, does not require sedation, and avoids major risks such as bleeding and perforations.21 However, in the event of a polyp being detected a standard colonoscopy is still required for its removal. As with standard colonoscopy, bowel preparation is required and the result depends upon the operator’s skill in the interpretation of the results.21 A possible risk of screening with CT-colonography is that the radiation exposure might promote new cancers – a published estimate is a 0.14% risk.18 Though few centres are equipped to carry out the procedure, recent guidelines have endorsed it as sufficient screening test.

Capsule Endoscopy

Similar to CT-colonography, capsule endoscopy aims to avoid the invasiveness of traditional colonoscopy. In capsule endoscopy, a small pill equipped with a camera is swallowed and passed through the bowel to collect images.22 Capsule endoscopy does not allow for biopsy or operator steering, and still requires a dietary bowel preparation, but does not require sedation.23 Though at present it is used in Europe, investigations of the current technology indicate a lack of sensitivity to warrant replacing other screening test.24

CONCLUSION

Since its development, colonoscopy has been widely used to screen for and diagnose colorectal cancers. However, because it is an invasive and costly test that requires extensive preparation by the patient and technical expertise to be performed it is not ideal for this purpose. In response to these limitations, several innovations have focused on less invasive and more accurate means of screening and diagnosis to compliment standard colonoscopy in the management of colorectal cancers.

REFERENCES

13. Hookey LC, Vanner SJ. Pico-salax plus two-day bisacodyl is superior to pico-salax alone or oral sodium phosphate for colon cleansing before colonoscopy. Am J Gastroenterol. 2009 Mar; 104(4); 703-709.


