Screening for colorectal cancer

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This is a translation of version 1, published on April 11, 2000.
The latest version of this report is not available in English.

Published March 14, 2001
Version 1

Findings by Alert

Cancer of the colon and rectum is third most common cause of death from cancer. Each year, approximately 2 500 people in Sweden die because of the disease. The risk of being affected is the same in men and women and increases with age. One way to reduce morbidity and mortality is to detect cancer at an early stage where surgical intervention has good results. General screening in the population can be conducted with the help of a test that measures occult blood in the feces (Hemoccult). Individuals who are included in the program receive a sample kit by mail. An envelope containing a feces sample is sent to a laboratory for analysis. If blood is found in the feces further studies are conducted. Surgery is often performed in patients found to have cancer.

The effects of screening on mortality have been studied in four large randomized studies. Furthermore, the costs and cost effectiveness have been estimated in several studies. The results uniformly show that screening reduces mortality from colorectal cancer. The absolute risk is reduced between 0.08 percent to 0.26 percent. SBU has calculated the economic impact of conducting a screening program throughout Sweden which is similar in design to a program in Denmark. Analysis shows that the number of deaths could be reduced by approximately 400 per year at a cost of 139 million SEK. The cost of avoiding one case of death from colorectal cancer would be approximately 300 000 SEK.

Alert finds there is good* scientific evidence concerning the effects of this method on mortality. There is moderate* evidence concerning the risks and side effects. There is moderate* evidence concerning the costs and cost-effectiveness of screening for colorectal cancer.

The scientific findings suggest that screening helps reduce mortality from colorectal cancer. The reported effects vary in different studies due to variations in program design. The potential benefits in terms of life years gained that can be achieved through a general screening program must be weighed against the costs and potential negative effects. The introduction of general screening for colorectal cancer in Sweden would require extensive organizational change and a major redistribution of qualified staff from other activities in health care. Due to uncertainty concerning optimum program design, the negative consequences, the necessity to redistribute healthcare resources, and deficient knowledge concerning psychological impact and cost effectiveness, a general screening program for colorectal cancer should not be undertaken at this time. Until further notice, screening for colorectal cancer should take place only within the framework of scientific assessments.

*This assessment by SBU Alert uses a 4-point scale to grade the quality and evidence of the scientific documentation. The grades indicate: (1) good, (2) moderate, (3) poor, or (4) no scientific evidence on the subject. For further information please see “Grading of evidence”.

Alert is a joint effort by the Swedish Council on Technology Assessment in Health Care (SBU), the Medical Products Agency, the National Board of Health and Welfare, and the Federation of Swedish County Councils.

Technology

Cancer in the colon or rectum affects approximately 3 300 and 1 800 people respectively in Sweden each year. In 1996, 7 100 individuals affected by colorectal cancer received care, consuming 138 000 patient days. Mortality is approximately 2 500 deaths per year.

Screening for colorectal cancer aims at detecting the disease at a stage which is more responsive to curative treatment. General screening is targeted at groups in the population at greatest risk for the disease. Screening programs for colorectal cancer that have been conducted elsewhere in the world have targeted both men and women aged between 45 and 80 years. These programs have used a test that measures blood in feces to detect cancer or the preliminary stages of cancer. The process is the following: a letter is sent to individuals in the target group along with a test kit to collect feces samples. A return envelope is used to send the sample to a laboratory for analysis. If cancer is suspected, a complementary examination is conducted to confirm the diagnosis. The most common method is coloscopy, but x-ray of the colon plus sigmoidoscopy or rectoscopy are also used. Screening is often repeated at 2-year intervals.

If studies detect cancer or adenomatous polyps (preliminary stage of cancer), the patient is offered various treatment options, eg, endoscopic surgery (mainly for polyps) or open surgery, which involves removing part or all of the intestine (mainly for cancer).

Target group

In two large randomized studies, the target group consisted of all individuals in the population aged 45 to 75 years [9,11]. In Sweden this would correspond to approximately 3 million individuals, which appears to be an unrealistically large target group. Other target groups have been discussed for routine studies. A Danish model study to assess the effectiveness of screening programs of various designs arrived at the conclusion that a screening program should, at minimum, include the age group 65 through 74 years [7]. Screening every second year of this more limited target group would require 250 000 examinations per year given a 70 percent participation rate.

Relation to other technology

Alternatives to population-based screening would be to more actively diagnose symptoms where cancer is suspected as the cause and increase prevention programs to reduce the incidence of the disease. Lifestyle changes such as diet (low in fat and high in fiber) and physical activity can reduce the risk for disease. However, no assessments have been published to show whether active diagnosis or preventive programs are cost effective.

Patient benefits

Screening for colorectal cancer has been assessed in four large randomized studies in four different countries [9,10,11,13,14]. The design of the four studies is basically the same, but minor variations exist. The Swedish and the American studies used a somewhat different analytical method (rehydration), which means the test was more sensitive. Other important characteristics are reported in the table (appendix). Three of the studies reported the effects on mortality. Relative mortality from colorectal cancer declined between 15 percent and 33 percent, while risk reduction in absolute numbers varied between 0.06 percent and 0.26 percent. Unpublished information from the Swedish study indicated that relative mortality declined by 12 percent. In most literature reviews of randomized and nonrandomized trials, the authors draw the conclusions that screening for colorectal cancer can reduce mortality from the disease [16,19,22,23]. A meta-analysis performed within the framework of the Cochrane Collaboration shows a 16 percent reduction in relative mortality from the disease
(RR 0.84, KI 0.77–0.93).

Complications and side effects

The Hemoccult II screening test does not involve any risks or side effects for the individual being tested. However, all types of screening programs lead to increased anxiety in the screened group. Coloscopy, as a followup investigative method, is associated with some discomfort and may cause a few, but serious, complications such as perforation of the intestine (0.1 %) and bleeding. For every 10 000 invited to screening, 1.8 to 3.4 individuals are expected to suffer perforation or bleeding [23].

Costs and cost-effectiveness

Over 20 scientific articles are available on the economic aspects of screening programs for colorectal cancer. In some cases the same study has been reported in two or more articles. The studies show major variations in findings because of different national conditions and differences in the primary data. An intermediate endpoint is cost per cancer detected. Converting directly to Swedish crowns (SEK) based on the current exchange rate shows that the cost per detected cancer varies from 35 400 and 256 200 SEK [4,5,15,21,25,26]. The cost per life saved varies between 334 400 and 3 067 800 SEK [8,12,17]. The value of a saved life is difficult to calculate, and therefore the cost per life year gained is a better measure. This figure varies between 19 700 and 395 700 SEK in different studies [2,6,7,8,18,24,25]. The cost per quality adjusted life year (QALY) is between 4 680 and 76 900 SEK [8,26].

A Danish cost-effectiveness study from 1998 [7] simulated 60 different screening programs for colorectal cancer and identified six cost effective programs among them. The cost per life year gained in these studies varies between 17 000 and 26 000 Danish crowns (DKR) in 1993 prices. From this analysis, the conclusion could be drawn that screening programs, at minimum, should include the group aged 65 through 74 years and should be conducted every second year. The screening interval should be reduced to one year before including the group aged 50 through 54 years.

Data from a Danish trial in Fyn [11] with screening every second year is directed at the group aged 45 to 75 years and was used to calculate the consequences for Sweden [3]. During a 10-year period, it would translate to a total healthcare cost of 139 million SEK per year. Mortality would be reduced by approximately 431 cases per year. The cost to avoid one case of death from disease would be approximately 322 000 SEK. If, on average, 3 life years per saved life could be achieved, the cost to health care per life year gained would be approximately 100 000 SEK. If the gain is 5 years, the cost would be 65 000 SEK. The participants' cost for time in conjunction with screening and further examination should be added to this estimate. A pilot study from Uppsala of sigmoidoscopy in 60-year-olds showed that many individuals took 2 days from work to prepare for and take the examination.

Structure and organization of health services

Introduction of general screening for colorectal cancer would require substantial redistribution of staff resources from other activities in the gastrointestinal field for diagnosis, treatment, and followup. Without further studies it would be impossible to exactly calculate the negative impact which a rapid redistribution of resources would have.

Ethical aspects

Screening for colorectal cancer involves a range of ethical problems. The benefits of screening in terms of life years gained should be weighed against the risks, discomfort, time sacrificed, and other costs that screening generates for a large number of individuals. A particular ethical problem is the high percentage of false-positive test results (over 80% in Hemoccult testing) [23]. Therefore, it is necessary to place high demands on the specificity, sensitivity, reliability, and predictive value of a screening program.

Until further notice, screening for colorectal cancer should be considered a trial activity. Hence, every individual who is invited to participate in such a study must receive correct information about the expected benefits and risks of the examination.

Diffusion in Sweden

We are not aware of any screening program for colorectal cancer in Sweden.

Current evaluation research

In a report from 1997 [1], AHTAC (Australian Health Technology Advisory Committee) recommends that the conditions for starting a population screening program for colorectal cancer in a risk population (healthy individuals over age 50) should be investigated. Smaller trials to test the implementability, acceptance, and cost-effectiveness of introducing such a program should be conducted.

An alternative screening method being tested in Great Britain is to perform sigmoidoscopy on everyone in the target group and offer coloscopy to those with positive findings. Another alternative being discussed is to perform coloscopy on everyone in a target group on a single occasion with later followup of positive findings. Computed tomography and MRI are being used in developing new methods for colon examination. In the future, these methods may be easier to perform than coloscopy.

Experts

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References

1. Australian Health Technology Advisory Committe. Colorectal cancer screening. December 1997. Commonwealth Department of Health and Family Services. Australia, 1997.
2. Office of Technology Assessment. The Costs and Effectiveness ot Colorectal Cancer Screening in the Elderly. USA, 1990.
3. Bäckman K, Carlsson P, Arbman G. Kostnader att screena för kolorektal cancer i Sverige. SBU, Arbets-PM, 2000-01-17. Framtaget i samarbete med Landstinget i Östergötland.
4. Castiglione G, Zappa M, Grazzini G et al. Cost analysis in a population based screening programme for colorectal cancer: comparison of immunochemical and guaiac faecal occult blood testing. Journal of Medical Screening 1997;4:142-146.
5. Gow J. Costs of screening for colorectal cancer: an Australian programme. Health Economy 1999;8:531-540.
6. Gyrd-Hansen D. Is it cost effective to introduce screening programmes for colorectal cancer? Illustrating the principles of optimal resource allocation. Health Policy 1997;41:189-199.
7. Gyrd-Hansen D, Søgaard J, Kronborg O. Colorectal cancer screening: efficiency and effectiveness. Health Economy. 1998;7:9-20.
8. Hakamaa M & Hristova L. Effect of Screening in the Nordic Cancer Control Up to the Year 2017. Acta Oncologica 1997;36:119-128.
9. Hardcastle JD, Chamberlain JO, Robinson MHE et al. Randomised controlled trial of faecal-occult-blood screening for colorectal cancer. Lancet 1996;348:1472-77.
10. Kewenter J, Brevinge H, Engarås B et al. Results of screening, rescreening, and follow-up in a prospective randomized study for detection of colorectal cancer by fecal occult blodd testing. Results for 68 308 subjects. Scand J Gastroenterol 1994;29:468-473.
11. Kronborg O, Fenger C, Olsen J et al. Randomised study of screening for colorectal cancer with faecal-occult-blood test. Lancet 1996;348:1467-71.
12. Liebeman DA. Cost-effectiveness Model for Colon Cancer screening. Gastroenterology 1995;109:1781-1790.
13. Mandel JS, Bond JH, Church TR et al. Reducing mortality from colorectal cancer by screening for fecal occult blood. N Eng J Med 1993;328:1365-71.
14. Mandel JS, Church TR, Ederer F, Bond JH. Colorectal cancer mortality: effectiveness of biennial screening for fecal occult blood. J Natl Cancer Inst 1999;91:434-7.
15. Manus B, Brägelmann R, Armbrecht U et al. Screening for gastrointestinal neoplasia: efficacy and cost of two different approaches in a clinical rehabilitation centre. European Journal of Cancer Prevention 1996;5:49-55.
16. Markowitz AJ & Winawer SJ. Screening and surveillance for colorectal carcinoma. Hematology 1997;11:578-608.
17. Marshall JR, Fay D & Lance P. Potential Cost of Flexible Sigmoidoscopy-Based Colorectal Cancer Screening. Gastroenterology 1996;111:1411-1417.
18. Norum J. Prevention of colorectal cancer: A cost-effectiveness approach to a screening model employing sigmoidoscopy. Annals of Oncology 1998;8:613-618.
19. Ransohoff DF & Lang CA. Screening for Colorectal cancer with the fecal Occult blood Test: A Background Paper. Ann Intern Med 1997;126:811-822.
20. Robinson MHE, Hardcastle JD, Moss SM et al. The risk of screening: data from the Nottingham randomised controlled trial of faecal occult blood screening for colorectal cancer. Gut 1999;45:588-592.
21. Sieg A, Hertel A, John MR et al. Screening for colorectal neoplasmas with a new immunological human faecal haemoglobin and albumin test. European Journal of Cancer Prevention 1998;7:279-285.
22. Simon JB. Faecal occult Blood Testing: Clinical value and Limitations. The Gastroenterologist 1998;6:66-78.
23. Towler B, Irwing L, Glasziou P et al. A systematic review of the effects of screening for colorectal cancer using the faecal occult blood test, hemoccult. BMJ 1998;317:559-65.
24. Wagner JL, Tunis S, Brown M et al. Cost-Effectiveness of Colorectal Cancer Screening Average-Risk Adults. In: Prevention and Early Detection of Colorectal Cancer, Red: Young GP. England 1996.
25. Weller D, Moss J, Hiller J et al. Screening for colorectal cancer: what are the costs?. Int Journal of Technology Assessment in Health Care 1995;11:26-39.
26. Whynes DK, Neilson AR, Walker AR et al. Faecal occult blood screening for colorectal cancer: is it cost-effective? Health Economics 1998;7:21-29.

Randomized trials of colorectal cancer screening.

Author	Kronborg [11]	Hardcastle [9]	Kewenter [10]	Mandel [13,14]
Yr. Published	1996	1996	1994	1993, 1999
Country	Denmark	Great Britain	Sweden	USA
Period	1985–1995	1981–1995	1982–	1975–1992
Target group	45–75 yr	45–74 yr	60–64 yr	50–80 yr
Pop 1000s	31 + 31	75 + 75	34 + 34	16 + 16 + 15
Method	Hemoccult II, not rehydration	Hemoccult II, not rehydration	Hemoccult II, rehyd/ not rehydration	Hemoccult II, rehyd
Interval	2 yr	2 yr	16–24 mon	1 yr & 2 yr
Effect on mortality Relative %	–18%	–15%	(–12%)	1 yr – 33% 2 yr – 21%
Sign	yes, p=0,03	yes, p=0,026	–	1 yr: Yes
Absolute %	0,16	0,08	–	1 yr: 0,26
NNS	470	747	–	360

Note: NNS= Number needed to screen to avoid one death from colorectal cancer [20]