Population-based assessment of the performance of sigmoidoscopy in the detection of colorectal cancer: implications for future screening recommendations

Omar Abdel-Rahman, Winson Y. Cheung

Department of Oncology, University of Calgary, Tom Baker Cancer Centre, Calgary, Alberta, Canada

Correspondence to: Winson Y. Cheung, MD, MPH, FRCPC. Medical Director, Health Services Research, Cancer Control Alberta, Associate Professor, Department of Oncology, University of Calgary, Staff Medical Oncologist, Tom Baker Cancer Centre, Calgary, Alberta, Canada. Email winson.cheung@ahs.ca.

Abstract: Current North American guidelines endorse the use of flexible sigmoidoscopy every 10 years as an alternative to fecal testing for the screening of colorectal cancer (CRC). The present study aims to evaluate its performance in a hypothetical population-based scenario, using data from the Surveillance, Epidemiology and End Results (SEER)-18 database. We explored the SEER database with the SEER*stat software. All cases diagnosed as colorectal carcinoma within the age group of 50–74 years during the year 2010 were included. Cases were considered either accessible or non-accessible to detection by screening sigmoidoscopy by virtue of their anatomic location. For example, cases within the rectum, sigmoid or descending colon were considered accessible whereas cases within other colorectal sub-sites were considered non-accessible. Assuming that all eligible United States' citizens underwent screening sigmoidoscopy and assuming that all CRC cases within accessible sites were correctly identified by sigmoidoscopy, true positive, true negative, and false negative cases were calculated. False positive cases, however, were non-calculable. Sensitivity and negative predictive value (NPV) of screening sigmoidoscopy were derived accordingly. A total of 18,794 patients aged between 50–74 years were diagnosed in 2010. The total United States' population covered by the SEER-18 registry in the same year and within the same age group was 21,613,411 individuals. A total of 10,786 CRC patients (57.4%) were diagnosed in sigmoidoscopy-accessible sites, 7,532 CRC patients (40.1%) were diagnosed in sigmoidoscopy-non-accessible sites, and an additional 476 patients (2.5%) were identified as unknown sub-sites. This translated into 2,853 CRC-related deaths at 5 years for sigmoidoscopy-accessible tumors versus 2,126 CRC-related deaths for sigmoidoscopy-non-accessible tumors. Based on the study's assumptions, sensitivity of screening sigmoidoscopy would be 58.8% and NPV would be 99.9%. Flexible sigmoidoscopy has an unacceptably low sensitivity for the detection of right-sided CRC; therefore, its use as a first-line screening modality should be questioned. Additional studies on alternative screening options for right-sided CRC are warranted.

Keywords: Colon cancer; sigmoidoscopy; colonoscopy

Introduction

Colorectal cancer (CRC) is one of the most common incident cancers as well as one of the most common causes of cancer deaths worldwide (1). Current North American guidelines advocate for the use of flexible sigmoidoscopy every 10 years as an alternative screening strategy for the detection of CRC among average-risk individuals (2). However, other international guidelines (e.g., Australian) recommend against its routine use in CRC screening (3). The current study aims at evaluating its

Table 1 Baseline characteristics of included cohort of colorectal cancer patients aged 50–74 years; diagnosed in the year 2010 (18,794 patients)

Parameter	N (%)
Age, years	
50–54	3,075 (16.4)
55–59	3,361 (17.9)
60–64	4,036 (21.5)
65–69	4,139 (22.0)
70–74	4,183 (22.3)
Race	
White	14,382 (76.5)
Black	2,541 (13.5)
Others	1,733 (9.2)
Unknown	138 (0.8)
Gender	
Male	10,613 (56.5)
Female	8,181 (43.5)
Sub site	
Cecum	2,620 (13.8)
Appendix	325 (1.7)
Ascending colon	2,387 (12.7)
Hepatic flexure	337 (1.8)
Transverse colon	1,216 (6.5)
Splenic flexure	427 (2.3)
Descending colon	884 (4.7)
Colon, NOS	346 (1.8)
Rectosigmoid junction	1,640 (8.7)
Rectum	4,120 (21.8)

performance in a hypothetical population-based model based on the Surveillance, Epidemiology and End Results (SEER)-18 registry database (4).

Methods

We explored SEER database through SEER*stat software. Cases diagnosed as colorectal carcinoma within the age group of 50–74 years during the year 2010 were included.

Cases were classified as either accessible or non-accessible to detection by screening sigmoidoscopy by virtue of their anatomic location (tumors within the rectum, sigmoid or descending colon were considered accessible, while cases within other colorectal sub-sites were considered non-accessible). Overall, US citizens within the age group of 50–74 years covered by the SEER-18 registry were determined from SEER rate session. Assuming that all eligible US citizens underwent screening sigmoidoscopy and assuming that all CRC cases within accessible sites were correctly identified by sigmoidoscopy, true positive, true negative, and false negative rates were calculated. False positive cases could not be derived due to data limitations. Sensitivity and negative predictive value (NPV) of screening sigmoidoscopy were also computed.

Results

A total of 18,794 patients aged between 50–74 years old were diagnosed during 2010 (total US population covered by the SEER-18 registry in the same year and within the same age group included 21,613,411 US citizens). A total of 10,786 CRC patients (57.4%) were diagnosed within sigmoidoscopy-accessible sites, 7,532 CRC patients (40.1%) were diagnosed within sigmoidoscopy-non-accessible sites and an additional 476 patients (2.5%) were diagnosed with unknown sub-sites. This translated into 2,853 CRC-related deaths at 5 years for sigmoidoscopy-accessible deaths versus 2,126 CRC-related deaths for sigmoidoscopy-non-accessible deaths. Additional baseline characteristics of the CRC cohort are available in *Table 1*. Based on the assumptions detailed above, sensitivity of screening sigmoidoscopy would be 58.8% and NPV would be 99.9%.

Discussion and conclusions

The current population-based study suggests that flexible sigmoidoscopy alone has a relatively low sensitivity for the detection of CRC, in particular tumors on the right-side, and thus it may be insufficient as a single screening modality. It should also be noted that the estimates in the current study were based on the assumption that all left-sided cases are successfully detected by flexible sigmoidoscopy which is likely optimistic. If additional left-sided cases were missed by flexible sigmoidoscopy, sensitivity would be poorer.

Unfortunately, previous studies have shown that

colonoscopy has a limited sensitivity in the detection of right-sided CRC lesions. This has been attributed in part to poor pre-colonoscopy preparation and/or lack of experience of the endoscopists (5). Fecal testing appears to be an appropriate starting point for the screening pathway for average-risk patients. Additional studies should strive to improve the detection rates of right-sided CRC, possibly through better colonoscopy techniques or use of CT colonography.

Acknowledgements

None.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. Globocan cancer registry. Available online: globocan.iarc.fr.
2. NCCN guidelines. Available online: https://www.nccn.org/professionals/physician_gls/pdf/colorectal_screening.pdf.
3. Cancer guidelines Australia. Available online: https://wiki.cancer.org.au/australia/Guidelines:Colorectal_cancer
4. Surveillance, Epidemiology, and End Results (SEER) Program. SEER*Stat Database: Incidence - SEER 18 Regs Custom Data (with additional treatment fields), Nov 2017 Sub (1973-2015 varying) - Linked To County Attributes - Total U.S., 1969-2016 Counties, National Cancer Institute, DCCPS, Surveillance Research Program, released April 2018, based on the November 2017 submission. Available online: https://seer.cancer.gov/
5. Neugut AI, Lebwohl B. Colonoscopy vs sigmoidoscopy screening: Getting it right. JAMA 2010;304:461-2.