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Prevalence and Distribution of Adenomas in Black Americans Undergoing Colorectal Cancer Screening

Frank K. Friedenberg, MD, MS (Epi), Mandeep Singh, MD, Nina S. George, DO, Abhinav Sankineni, MD, MPH, and Swetang Shah, MD, MPH

Department of Medicine and Gastroenterology Section, Temple University School of Medicine, Philadelphia, PA

Abstract

Background—The American College of Gastroenterology recommends colorectal cancer (CRC) screening for average risk Blacks Americans ages 45-49. This is based on this group's younger age for the development of adenomas and CRC. Our purpose was to determine the yield of CRC screening in average risk Black Americans including those < age 50. We also aimed to identify whether there was a higher prevalence of proximal adenomas in Black Americans.

Study—Cross sectional, retrospective. All colonoscopy examinations from 2007 through 2010 were reviewed. Complete examinations with a good/excellent preparation in average risk Black patients 45-49 were selected. We excluded patients with signs, symptoms, or family history of CRC. Defined two control groups: average risk Black and White patients ages 50-59 who completed a colonoscopy during the same period. Patient's height, weight and use of statin medications and aspirin were recorded. Patients currently using tobacco at least weekly were identified.

Results—There were 1,230 patients with an adenoma for a prevalence of 40.7%. We included 304 Black Americans 45-49 years, 669 Black Americans 50-59 years, and 257 Whites 50-59 years. There was no association between race/age group and the presence of at least one adenoma, proximal adenomas, or advanced adenomas. In regression modeling, both male sex and active smoking were associated with all three outcomes.

Conclusions—Male sex and active smoking are risk factors for prevalent adenomas, proximal adenomas, and advanced adenomas. The prevalence of adenomas is similar in Black Americans 45-49 compared to older Black and White patients. We did not find that the recognized proximal distribution of CRC in Black Americans parallels a similar distribution in adenomas in this group.

Keywords

Black American; colon cancer; adenoma; screening

Introduction

Colorectal cancer is the third most commonly diagnosed cancer and the second leading cause of cancer death in both men and women in the US, with about 148,810 new cases and

Contact: Frank K. Friedenberg, MD, MS (Epi), Gastroenterology Section, Temple University, 3401 North Broad Street, Philadelphia, PA 19140, Phone: 215-707-4391, Fax: 215-707-2684.

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49,960 deaths per year. [1] Colorectal cancer incidence and mortality rates are highest in Black American men and women. [1] Among Black Americans, incidence rates are more than 20% higher and mortality rates are about 45% higher than those in Whites. [2] Several studies have documented that Black American patients are more likely to be diagnosed after the disease has spread beyond the colon. [3-9] In addition, Black Americans with colorectal cancer are less likely than white patients to receive recommended surgical treatment and adjuvant therapy. [3-9]

There is a parallel prevalence of adenomas and carcinomas, with the average age of patients with adenomas being 5 to 7 years younger than that of patients with carcinomas.[10] Approximately 5% to 7% of patients with adenomas have severe dysplasia and 3% to 5% have invasive carcinoma at the time of diagnosis.[11] Increasing dysplasia and, presumably, malignant potential correlate with increasing adenoma size, villous component, and patient age.[11] The likelihood of invasive carcinoma also increases with increasing adenoma size. [12]

The anatomic distribution is similar for adenomas and carcinomas at the individual patient level. [13-15] At the population level, studies have suggested that proximal colorectal cancers (i.e. those proximal to the splenic flexure) occur in higher frequency in the Black American population relative to other racial groups. [4,16]

Based on the knowledge of the differences in biologic behavior and anatomical distribution of colorectal cancers for Black Americans, it would be expected that the prevalence of proximal adenomas and advanced adenomas would be higher in Black Americans undergoing colorectal cancer (CRC) screening relative to Whites. Previously performed studies looking at this issue have had limitations including the failure to exclude symptomatic patients or the use of very small data sets.[17,18] Therefore, data on the anatomical distribution of adenomas in average risk Black Americans undergoing colonoscopy for screening is lacking. An additional related area in which evidence is lacking is the proposal by the American College of Gastroenterology to begin screening average risk Black Americans at age 45 years for CRC.[19] Validation of this proposal is needed. Therefore our study has two aims. First, we desired to clarify the anatomic distribution of adenomas in a large study group of average risk Black and White patients. Secondly, we wanted to provide data on the yield of average risk CRC screening in Black patients under the age of 50 years.

Patients and Methods

The study methodology was retrospective, cross sectional. The setting was a single, urban institution. We reviewed the reports of all individuals ages 45-59 undergoing healthy screening colonoscopy from January 1, 2007 to December 31, 2010. We chose this time period because we began CRC screening in average risk Black patients under the age of 50 starting in 2007. To ascertain cases we selected only those cases in which the indication selected by the endoscopist was "Colorectal Cancer Screening, Average Risk". Subsequent manual review of the chart was performed to avoid misclassification. Specifically we confirmed that the patient was asymptomatic, had no overt or obscure signs or symptoms of lower gastrointestinal bleeding, and had a negative family history of CRC. A prior history of a screening colonoscopy, colon adenomas, or inflammatory bowel disease was also grounds for exclusion. We then selected only those cases in which the patient categorized themselves as Black American or non-Hispanic White during outpatient registration. We further restricted our study group to colonoscopy examinations which were complete and the preparation was described as good or excellent. Those cases in which the preparation was described with the other software choices (unsatisfactory, poor, or fair) were eliminated.

Photography of the appendiceal orifice and ileocecal valve was required to assess completeness. The location, size, and histology of all adenomas were cataloged. For this study a proximal adenoma was defined as any adenoma proximal to the splenic flexure. Adenomas were considered “advanced” if they met any of the following: size > 10 mm, containing villous features, or containing high grade dysplasia. [20]

Through manual chart review we recorded the patient’s smoking history as well as their use of aspirin and statin medications. Patients were considered to be active smokers if they smoked at least weekly. Body mass index on the day of colonoscopy was ascertained from the nursing record. All patients meeting inclusion criteria were divided into three racial/age groups: Black Americans <50 years, Black Americans ages 50-59 years and White patients ages 50-59 years.

Statistical Analysis

Univariate comparisons of categorical and continuous predictor variables were accomplished using the chi-square test, independent sample t-test, or 1-way ANOVA. The common odds ratio and associated 95% confidence interval were calculated for categorical variables using the Cochran-Mantel-Haenszel statistic. We performed sequential analyses. In the first model the presence or absence of an adenoma was used as the outcome variable. Then the presence or absence of a proximal adenoma and the presence or absence of an advanced adenoma as the outcome variable was substituted. We performed independent binary logistic regression analyses to look for variables associated with the presence or absence of adenomas, proximal adenomas, and advanced adenomas. From this analysis the odds ratios and 95% confidence intervals of the odds ratios were determined. A priori we planned to use the racial/age groups as a predictor variable. All data was recorded using Microsoft Access (Microsoft™, Redmond, WA) and downloaded into IBM SPSS Statistics 18 (IBM, Chicago IL) for analysis. A 2-tailed P value 0.05 was considered statistically significant.

Study Sample Size and Power

Our primary outcome of interest was the presence of an adenoma. Additional outcomes were the presence of proximal adenomas and advanced adenomas. We assumed that the prevalence of adenomas in the patients over 50 (both Black and White) would be 30% (two groups combined for power analysis). In order to show that the proportion of patients with adenomas for the group consisting of Black Americans ages 45-49 years was no more than 10% lower (i.e. 20%) than the reference group, a minimum of 291 patients were needed for each group assuming $\alpha = 0.05$ and $\beta = 0.20$. We felt that an adenoma detection rate this high in the younger group was clinically meaningful.

Results

After application of exclusion criteria there were 1,230 patients included for analysis. A patient flow chart is provided in Figure 1. Ultimately we included 304 Black Americans 45-49 years, 669 Black Americans 50-59 years, and 257 Whites 50-59 years. Table 1 highlights the characteristics of the study groups. The proportion of males in each group was similar. Black American patients were more likely to be active smokers. Older patients were more likely to consume aspirin and statin drugs on a regular basis.

Univariate Analysis

Overall, 501 patients had at least one adenoma for a prevalence of 40.7%. The frequency distribution of detected adenomas is shown in Table 2. There was no association between race/age group and the presence of at least one adenoma. Similarly, there was no association

between race/age group and the presence of a proximal adenoma or advanced adenoma. For the entire study group, the odds ratio that an advanced adenoma was located proximal to the splenic flexure was 7.9 (5.0-12.7). Only one malignancy was detected in this group of average risk CRC screening patients.

Table 3 demonstrates that there was no association between obesity status, statin or aspirin use and the presence of an adenoma, proximal adenoma, or advanced adenoma. However, both male sex and active smoking were significantly associated with all three of these outcome variables.

Logistic Regression Analysis

Table 4 shows the output for the binary logistic regression. After adjustment for all other variables there was no association between age/race group and the presence of adenomas, proximal adenomas, or advanced adenomas. The associated variables which remained significant were male sex and tobacco use. Statin use increased the odds for the presence of proximal adenomas 1.38 (1.0-1.90), but was not associated with the overall prevalence of adenomas or advanced adenomas. Figure 2 highlights the relationship between sex by smoking status and the prevalence of adenomas.

Discussion

Our study was unable to identify Black American race as a significant risk factor for the presence of adenomas, adenomas proximal to the splenic flexure, or adenomas containing advanced features. Our hypothesis, based on the accumulated data showing a predilection for proximal adenocarcinomas in Black Americans, was that the distribution of these precursor lesions would be similar. In our study group only male sex and active smoking were independent risk factors for all three adenoma outcomes. A second aim of our study was to provide data concerning CRC screening for average risk Black Americans ages 45-49 years. Our results show that the prevalence of adenomas, proximal adenomas, and advanced adenomas were not statistically different from control groups consisting of White and Black patients 50-59 years.

Our study's conclusions differ from several previous publications. Offerhaus et al, using autopsy data, found that the prevalence of adenomas in the right colon was increased in Black Americans.[17] They found that Blacks had a ratio of right-sided to left-sided adenomas greater than unity in both the 1970's and 1980's (1.19 vs. 1.79). Similarly, Ozick, et al, in a group of 141 Black Americans, found 171 adenomas of which 57% were proximal to the splenic flexure. [21] Neither of these studies excluded individuals with symptoms of colorectal disease or otherwise at high risk. Another study of Black Americans found that nearly two-thirds of detected adenomas were identified in the right colon. [18] However, this study included only 121 asymptomatic Black Americans undergoing screening colonoscopy. [18]

The database derived from the NIH-sponsored Clinical Outcomes Research Initiative (CORI) perhaps provides the best information available to examine the association between race and the distribution of colorectal adenomas. The database is populated with reports from over 500 physicians practicing in 25 states. [22] Using CORI data from 2002-2003, Thornton et al found that Black Americans had a modestly increased risk of proximal adenomas (OR = 1.30; 95% CI: 1.11-1.52). [23] Results from CORI for the years 2004-2005, which included over 85,000 patients, found that the adjusted prevalence of proximal adenomas > 9 mm was no different between black and white patients.[22] Data for smaller adenomas were not presented. Important limitations of CORI are the inability to

identify whether patients had colon examinations prior to entering the database and the possibility of including subjects with a family history of adenomas or colorectal cancer. [22]

The discordance between sub-site prevalence of colorectal adenomas in our study and the heretofore recognized distribution of cancers in Black Americans may be due to several factors. Proximal adenoma progression in the right colon of Black Americans may occur more rapidly shortening the interval during which adenoma detection could occur. A higher prevalence of flat adenomas also would explain the failure to identify malignant precursors on a screening exam. Finally, the protective effect of colonoscopy for the prevention of proximal colonic neoplasms may be more evident in Whites than Black Americans. The protective effect of colonoscopy on proximal neoplasms has recently been called into question and perhaps, it is a less effective tool in Black Americans. [24]

There has been a suggestion that Black patients between the ages of 45-49 years should undergo colon cancer screening. [19,25] Our results demonstrated that the prevalence of adenomatous adenomas was equivalent to that found in older screening patients even after adjusting for potential confounding variables. A younger White group was not available to assess whether this finding is race specific. An argument in favor or against screening younger, average risk Black Americans can be made based on our findings. Of note, screening younger Black Americans was not adopted by the most recent guidelines from the US Multi-Society Task Force on Colorectal Cancer, and the American College of Radiology. [26,27] Arguments against the expansion of screening guidelines to include younger individuals include the significant financial costs and the shortage of available providers.

Identifying male sex as an independent explanatory variable associated with proximal adenomas was an important finding in our study. Our results agree with those of Penn and others who found that, in addition to older participants, males had an increased risk (OR = 1.67; 1.39-2.02) for prevalent colorectal adenomas in a large, racially diverse patient population. [28] This odds ratio is very similar to ours. These authors also found no difference in adenoma prevalence in White and Black patients. [28] A shortcoming of their study was the inclusion of fecal-occult blood test positive participants as well as a failure to provide an analysis stratified by adenoma location.

In our study smoking was also an independent risk for the presence of colorectal adenomas including advanced lesions. Our results are similar to other studies and two meta-analyses where tobacco smoking was associated with a higher prevalence of adenomas. [29-31] A recent study from Canada found that regular use of tobacco (as opposed to former use) was associated with prevalent rectal cancer (OR=2.41, 1.52 - 3.83). [32] Tobacco smoke is a major source of a wide variety of carcinogens including heterocyclic hydrocarbons and N-nitrosamines which may explain this relationship. [33]

Our study was likely underpowered to show differences in adenoma prevalence by several purported prevalence modifiers. For example, we were unable to identify an association between the regular use of aspirin and a lower risk of adenomas. A large body of consistent evidence suggests that regular use of aspirin and non-steroidal anti-inflammatory drugs are associated with a lower risk of colorectal adenomas. [34-37] Likewise, a protective benefit with the chronic use of statin medications has been seen in humans and animal models. [38,39] Our data paradoxically found the use of statins to be a risk for the presence of proximal adenomas. A Type I error cannot be excluded for this finding.

The principle strengths of our study are the selection criteria and sample size. Patients selected were definitively identified as average risk and the chances of misclassification were negligible. We only included examinations which were documented as complete in

which the preparation quality was good or excellent. The primary weakness of the study is the retrospective design. This creates the potential for misclassification to exposures of interest such as medication use and smoking. Similarly, unmeasured confounders which may be related to the outcome variables such as diet and exercise were not captured in this study. Moreover, we were unable to quantify exposures and therefore, for example, a threshold for tobacco use that places an individual at risk for adenomas cannot be ascertained. Exposure-Disease sequence also cannot be clarified in cross-sectional studies. For example, many patients may have been harboring adenomas prior to starting on a statin medication.

In conclusion, in a group of average risk patients undergoing colonoscopy for CRC screening, our study demonstrated that male sex and active smoking are risk factors for prevalent adenomas, adenomas proximal to the splenic flexure, and advanced adenomas. We demonstrated that the prevalence of adenomas is similar in Black Americans ages 45-49 in comparison to older Black and White patients. We were unable to show that the recognized proximal distribution of CRC in Black Americans parallels a similar distribution in adenomas in this group. Our study did not demonstrate a protective effect from the consumption of aspirin and statin medications. Recommendations to begin screening average risk Black Americans at ages 45-49 will require additional studies before this can be adopted as a standard practice.

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Figure 1.
Flow diagram of selected patients.

Figure 2.
Impact of sex and smoking status on adenoma prevalence.

Table 1

Characteristics of study group.

	White 50-59y (n=257)	Black 50-59y (n=669)	Black 45-49y (n=304)
Age (SD)	58.6 (6.4)	58.4 (7.2)	47.3 (2.3)
Males, n (%)	123 (47.9)	281 (42.0)	148 (48.7)
Body Mass Index, Kg/m ² (SD)	28.3 (5.9)	31.0 (7.1)	31.3 (7.1)
Current Smoker, n (%) [*]	71 (29.6)	286 (42.8)	142 (46.7)
Regular Aspirin, n (%)	69 (27.8)	251 (37.5)	45 (14.8)
Statin, n (%)	84 (33.6)	194 (29.0)	45 (14.8)

^{*} Defined as smoking at least one cigarette weekly.

SD – standard deviation.

Table 2

Colonoscopy findings for study group.

	Black	50 (n=669)	Black 45-49y (n=304)	P*	White	50y (n=257)	P**
Polyp Present, n (%)	287 (42.9)		115 (37.8)	0.14	99 (38.5)		0.43
Mean polyp/case (SD)	0.55 (1.3)		0.66 (1.3)	0.21	0.49 (0.83)		0.37
Proximal polyps, n (%)	162 (24.2)		58 (19.1)	0.08	61 (23.7)		0.27
Advanced Polyps, n (%)	43 (6.4)		27 (8.9)	0.17	18 (7.0)		0.18
Malignancy, n (%)	1 (0.15)		0 (0)		0 (0)		

* P value for the comparison of all Black patients only

** P value for comparison of all 3 groups. Chi-square used for all comparisons.

Table 3

Univariate risk factors for polyp findings.

	n*	Any Polyp n = 501 Odds Ratio (95% CI)	n	Proximal polyp n=281 Odds Ratio (95% CI)	n	Advanced Polyp n = 88 Odds Ratio (95% CI)
Sex (M/F)	255/246	1.51 (1.20-1.90)	159/122	1.84 (1.41-2.41)	54/34	2.05 (1.32-3.20)
BMI >30 Kg/m² (Y/N)	238/259	0.95 (0.76-1.19)	130/149	0.90 (0.69-1.18)	35/52	0.69 (0.44-1.08)
Regular Aspirin Use (Y/N)	160/335	1.21 (0.95-1.56)	87/190	1.10 (0.82-1.47)	31/56	1.33 (0.84-2.09)
Statin Use (Y/N)	143/353	1.23 (0.95-1.59)	86/192	1.34 (0.99-1.80)	23/64	1.00 (0.61-1.64)
Tobacco Use (Y/N)	246/245	1.86 (1.47-2.35)	137/140	1.55 (1.18-2.03)	53/34	2.37 (1.51-3.71)

* Column totals may not equal n values due to missing information. Missing data is as follows: BMI (n=9); Aspirin Use (n=9); Statin Use (n=7); Tobacco use (n=18)

Table 4

Output from Binary Logistic Regression Analysis.

[OR (95% CI)]			
	Polyp Present	Proximal polyp	Advanced Polyp
Ethnicity/Age Group			
White 50	1.0	1.0	1.0
Black 50	1.21 (0.88-1.66)	1.03 (0.72-1.47)	0.81 (0.44-1.47)
Black 45-49	0.98 (0.68-1.41)	0.74 (0.48-1.14)	1.26 (0.63-2.34)
Female	1.0	1.0	1.0
Male	1.49 (1.17-1.89)	1.86 (1.41-2.45)	1.80 (1.14-2.84)
Body Mass Index,			
<30 Kg/m²	1.0	1.0	1.0
30 Kg/m²	1.03 (0.81-1.31)	1.01 (0.77-1.34)	0.78 (0.50-1.23)
Tobacco Use			
No	1.0	1.0	1.0
Yes	1.81 (1.42-2.30)	1.50 (1.14-1.99)	2.23 (1.41-3.53)
Regular Aspirin Use			
No	1.0	1.0	1.0
Yes	1.12 (0.85-1.48)	0.96 (0.70-1.31)	1.54 (0.93-2.57)
Statin Use			
No	1.0	1.0	1.0
Yes	1.21 (0.92-1.60)	1.38 (1.0-1.90)	0.97 (0.56-1.67)

* OR values are adjusted for all other variables in table.