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Yield of screening and diagnostic colonoscopy for polyp and cancer detection

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ABSTRACT

Introduction: Colorectal cancer is the third most common disease affecting the global population, with 1.8 million new cases reported per year and a mortality rate of 8%. Currently, the optimum approach to the diagnosis and follow-up of the disease is colonoscopy. The present study aimed to compare the yield of the colonoscopy procedure among ages, genders, reasons for requesting a colonoscopy, presence/absence of family history and presence/absence of polyp/cancer detection history.

Materials and Methods: A retrospective examination was made of patients who were referred to the Endoscopy Unit of the Department of General Surgery of our center and who underwent colonoscopy for diagnostic and screening purposes within a three-year period between June 2016 and May 2019.

Results: Of the 2,075 patients included in the study from within the three-year period, 1,181 (57%) were male and the median age was 45 (18–93) years. Colonoscopy was performed for screening purposes on 105 (5%) of the patients, while the remaining 1.970 (95%) patients underwent colonoscopy due to the presence of various symptoms and complaints (bleeding, constipation, diarrhea, abdominal pain, inflammatory bowel disease, etc.). The total polyp detection rate was 13.8% (287) and the total adenoma detection rate was 9% (188). Of the patients who underwent colonoscopy, five (0.26%) were identified with interval colorectal cancer when the procedure was repeated for various indications.

Conclusion: Colonoscopic examination is the optimum approach to the detection, follow-up, and treatment of colorectal cancer or its precursors. The adenoma detection rates, polyp detection rates, and the interval cancer rates are the guiding tools that point out the importance and quality of colonoscopy.

Keywords: colonoscopy, polyp, cancer

Introduction

Colorectal cancer is the third most common disease affecting the global population, with 1.8 million new cases reported per year and a mortality rate of 8%. Currently, the optimum approach to the diagnosis and follow-up of the disease (including adenomatous polyps) is colonoscopy.[1-3] The lifetime risk of developing colorectal cancer is around 5% in many regions of the world, and it is known that the colonoscopic resection of adenomatous polyps, as precursors for cancer, reduces both the incidence and mortality related to cancer.[4] The prevalence of adenomas reaches 30% at 50 years of age and 50% at 70 years of age.[5] The popularity of colonoscopy is based on the technical and technological advances, patient comfort with conscious sedation and the relative safety of the procedure.[6] Colonoscopy has been compared with several methods, such as CT colonoscopy

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and capsule endoscopy, and tendencies toward such procedures may be expected in time.[7,8] Colonoscopy is often associated with certain complications; however, it remains the most popular procedure for the detection and successful removal of polyps.[9] When making a decision to perform a procedure, the expected benefit should obviously outweigh the potential risks. Several guidelines have been published on appropriate indications for colonoscopy and the appropriateness of the procedure, among which the most popular are those of the American Society for Gastrointestinal Endoscopy (ASGE) and the European Panel on the Appropriateness of Gastrointestinal Endoscopy (EPAGE) and their various updated versions.[10,11] Being aware of appropriate indications for colonoscopy is very important for the yield of the procedure, with procedural quality and interval cancer development being other important factors.

The present study aims to compare yield of colonoscopy procedure between ages, genders, reasons for requesting a colonoscopy, presence/absence of family history and presence/absence of polyp/cancer detection history. The yield of colonoscopies determined with polyp detection rate (PDR), adenoma detection rate (ADR) and cancer detection rate (CDR). Also, it aims to determine the interval cancer detection rates to compare with the literature.

Materials and Methods

A retrospective examination was made of patients who were referred to the Endoscopy Unit of the Department of General Surgery of our center, and who underwent colonoscopy for diagnostic and screening purposes within a three-year period between June 2016 and May 2019. Patient data were accessed through the hospital's automated system, and the patient records in the hospital archive were examined when necessary. Those with missing data were excluded from the study. Our study was carried out carefully and sensitively with full adherence to the principles of the Declaration of Helsinki.

Patient demographic data, indications for colonoscopy, presence in family history, indications for re-colonoscopy, results established on colonoscopy and the pathological examination results of patients who underwent biopsies were examined. The pathological examinations of the polyps were performed in accordance with the World Health Organization (WHO) criteria.[12] The polyps were examined under two main groups, as adenomatous and non-adenomatous, and under associated subgroups. The pathologies established on colonoscopy were defined as being either proximally or distally localized to the center of the transverse colon.

Our endoscopy unit is designed in accordance with international standards.[13] As required by the procedural safety and quality control mechanisms of our center, prior to the procedure, the physician determining the need for colonoscopy and recommending the procedure to the patient explains the process to the patient, including potential complications and the patient preparation procedures, in the outpatient clinic.All of the procedures assessed in the present study were carried out by 19 different physicians specialized in General Surgery who were employed in our unit during the study period, and all were experienced in endoscopic procedure.Almost all of the patients were examined under sedation. The patients initiated a pulpless, grainless and liquid diet for two days prior to the colonoscopy. One day before the colonoscopy, the patients were given two doses of 90 ml sodium phosphate as a laxative, and enema was administered twice.

Statistical Analyses

Categorical variables, expressed as numbers and percentages, were analyzed using χ^2 or Fisher's exact test, where appropriate. Continuous variables were expressed as median, or as mean and standard deviation, and 95% CI as appropriate, and the Student's t-test was used for the comparisons of means. All analyses were performed using the SPSS version 21.0 (SPSS INC, Chicago, IL, United States) software package. A two-tailed $p<0.05$ was considered statistically significant.

Results

Of the 2.075 patients included in the study from within the three-year period, 1.181 (57%) were male, the median age was 45 (18–93) years, and 12 patients with missing data were excluded from the study. Colonoscopy was performed for screening purposes on 105 (5%) of the patients, while the remaining 1.970 (95%) patients underwent colonoscopy due to the presence of various symptoms and complaints (bleeding, constipation, diarrhea, abdominal pain, inflammatory bowel disease, etc.). There were 1.249 (60.1%) patients over the age of 50 years, and among these, 154 (7.4%) had a re-colonoscopy within this period for various reasons (insufficient inspection, cancer, polyp detection, suboptimal inspection, etc.). Of the patients undergoing re-colonoscopy within this period, seven (4.5%) and 64 (41.8%) were detected to have cancer and polyps, respectively. The total polyp detection rate was 13.8% (287) and the total adenoma detection rate was 9% (188). Of the patients who underwent colonoscopy, five (0.26%) were identified with interval colorectal cancer when the procedure was repeated for various indications within the three-year period. The colonoscopy yield was 17.9% in terms of polyp and cancer detection, and 41.9% in terms of overall pathologies (Table 1).

Table 1. Patients features and colonoscopy findings

Variable	All (n=2075)	
	n	%
Sex		
Male	1181	57
Female	894	43
Age		
Median (min-max)	54	16-93
Age groups		
≤50 yr	826	39.9
>50 yr	1249	60.1
Family history		
Yes	327	15.8
No	1748	84.2
Indication		
Screening	105	5
Gastrointestinal bleedinga	713	34.3
Anemia	49	2.3
Constipation	672	32.3
Diarrhea	20	1
Abdominal pain	344	16.5
Inflammatory bowel disease	69	3.3
Others	103	5
Total Polip Detection	287	13.8
Neoplastic polyps	188	9.1
Non-neoplastic polyps	98	4.7
Cancer	86	4.1
Re-colonoscopy	153	7.37

	Polyp detection (yes)	Cancer detection (yes)	No Detection	Total
After Cancer Surgery	24	3	32	63
After Polyp Detection	25	2	13	43
After Suboptimal Intervention	11	1	19	31
Other	4	1	11	16
Total	64	7	75	153
Polyp Detection Rate (PDR) (%)				
Total	13.8			
>50 year	17.1			
Adenoma Detection Rate (ADR) (%)				
Total	9			
>50 year	11.2			

	n	%
Interval cancer detection (26 months median follow up)	5	0.26
Total Yield of Interventions		
for polyp & cancer		17.9
for overall		41.9

a.including fecal occult blood test positivity.

Colonoscopic inspections detected adenomatous polyps in 188 patients, and these colonoscopies identified 65.5% and 9% of the total patients with polyps detected and all patients undergoing colonoscopy, respectively. Adenomatous polyps were morphologically distributed into 136 (72.3%) tubular, 33 (17.5%) tubulovillous, 11 (5.8%) villous and eight (4.2%) serrated types. Of the adenomatous polyps, 22.3% (42) were in patients under 50 years of age, 67.5% (127) were in male patients and 81.9% (152) were in distal colonic segments (Table 2).

Of those detected with cancer, 17.4% (15) were under the age of 50 years. The total cancer detection rate from the colonoscopic procedures was 4.1% (86). Among the patients detected with cancer, 72% (62) were male, and cancer was detected in the distal colonic segment in 91.7% (78).

When cancer and polyp detection was evaluated based on a grouping of patient complaints, statistical significance was noted in the polyp detection rates of the different complaint groups (p=0.02). An analysis of this significance revealed polyp detection rates to be statistically significantly higher in patients with abdominal complaints (constipation, diarrhea, abdominal pain, inflammatory bowel disease) than in those undergoing colonoscopies for screening purposes. The polyp detection rates among patients with a history of cancer or polyps were statistically significantly higher than among those undergoing colonoscopies for screening purposes. The polyp detection rates among patients with a history of cancer or polyps were statistically significantly higher than those due to GIS bleeding or anemia (Table 3).

When the indications of colonoscopy were grouped (a. Screening, b. GIS bleeding or Anemia, c. Constipation or Diarrhea or Abdominal pain or IBS, d. history of cancer or polyps), no difference was established in the rate of cancer detection between the groups (p=0.116). An analysis of groups based on age revealed polyp or cancer detection rates statistically significantly higher in those over the age of 50 years (p<0.001, p=0.002, respectively). The analysis of groups based on gender revealed statistically significantly higher polyp or cancer detection rates in men (p<0.001, p=0.008, respectively) (Table 3).

Discussion

The risk of colorectal cancer development shows a clear increase in those over 50 years of age, with those under the age of 50 years accounting for only 10% of all cases.[14] The

Table 2. Distribution of the histologic types of polyps and cancer by grade of dysplasia, age, gender and location

Histologic type of polyps	Grade of dysplasia		Age groups		Gender		Location		Total
	High	Low	≤50 yr (%)	>50 yr (%)	Male (%)	Female (%)	Proximal (%)	Distal (%)	
Adenomatous polyps									
Tubular	30	106	31	105	90	46	26	110	136 (72.3)
Tubulo-villous	11	22	8	25	25	8	7	26	33 (17.5)
Villous	7	4	3	8	6	5	2	9	11 (5.8)
Serrated	3	5	0	8	6	2	1	7	8 (4.2)
Total Adenomatous polyps (%65.5)	51 (27.1)	137 (72.8)	42 (22.3)	146 (77.7)	127 (67.5)	61 (32.5)	36 (19.1)	152 (81.9)	188 (100)
Hyperplastic polyps			12	51	35	28	10	53	63 (63.6)
Inflammatory polyps			10	25	23	12	4	31	35 (35.3)
Juvenil polips			1	0	0	1	0	1	1 (1)
									99 (100)
Total Polyp Detection			64 (22.3)	222 (77.7)	185 (64.5)	102 (35.5)	50 (17.4)	237 (82.6)	287 (100)
Cancer			15 (17.4)	71 (82.6)	62 (72)	24 (28)	8 (9.3)	78 (91.7)	86 (100)
Total polyps & cancer			79	293	247	126	58	315	373 (100)

Table 3. Comparison of indications, age groups and gender by detecting polyp and cancer

Indications	Polip		p[y]	Cancer		p
	Yes, n (%) (n=261)	No, n (%) (n=1765)		Yes, n (%) (n=49)	No, n (%) (n=2026)	
a.Screening	7 (6.7)	98 (93.3)	0.02	0	105 (100)	0.161
b.Gis bleeding or Anemia	88 (11.2)	699 (88.8)		24 (2.9)	787 (97.1)	
c. Constipation or Diarrhea or Abdominal pain or IBD	152 (14.1)	928 (85.9)		25 (1.2)	1080 (98.8)	
d.With cancer or polyp history	14 (25.9)	40 (74.1)		0	54 (100)	
Age groups (%)						
≤50 yr	208 (2.2)	1049 (97.8)	<0.001	41 (3.1)	1257 (96.9)	0.002
>50 yr	53 (6.8)	716 (93.2)		8 (1)	769 (99)	
Gender, n (%)						
Male	174 (15.2)	969 (84.8)	<0.001	37 (3.1)	1143 (96.9)	0.008
Female	87 (9.9)	796 (90.1)		12 (1.3)	883 (98.7)	

x: Excluding cancers; y: meaningfulness are between a vs c, a vs d, b vs d, c vs d; IBD: inflammatory bowel disease

prevalence of adenoma is 9–16%, advanced adenoma is 3–6% and cancer is 0–2.6% among people over the age of 50 years.[15] This explicit difference between age groups is notable also in the present study, in which 50 years of age is identified as an independent risk factor for the detection of both cancer and polyps. Colorectal cancer is approximately 25% more common in men than in women,[15] and the findings of the present study are in line with literature in this regard.

Levin et al.[16] reported an annual decrease of 25% in colorectal cancer incidence, 52.4% in mortality and 10% in advance stage incidence when diagnosis is made through screening programs. The EPAGE study by Burnand et al. found no link between patient characteristics and the differences in the appropriateness and performance of screening colonoscopies between centers, although the use of screening colonoscopies in the presence of appropriate indication criteria was noted to enhance procedural efficiency.[17]

The colon cancer screening program (CCSP) has been applied in our country since September 2014, based on a fecal occult blood test once every two years and a colonoscopy once every 10 years for healthy individuals aged 50–70 years.[18] The screening process is usually led by the Cancer Early Diagnosis, Screening and Training Centers (KETEMs) affiliated with Primary Care Clinics. It can be said that the screening program in our country does not work to an optimum level for various reasons. An awareness study carried out by Pirincci et al.[19] found that 82.4% of the respondents were unaware of the existence of KETEM. Furthermore, the cultural structure of society determines the interest in the procedure, with Yakut et al.[20] reporting that asymptomatic individuals over the age of 50 years in our country were not sufficiently interested in screening programs. This may be because the public is not sufficiently informed about the need for screening and how to go about it, and so they fail to internalize the matter. According to the EPAGE II study by Arditi et al.,[9] the screening/diagnostic colonoscopy ratio among individuals who have had a colonoscopy varies from 1.8% to 22.6%, while Burnan et al.[17] reported a ratio of 1/10. The ratio in the present study was around 5%, which is consistent with literature. On the other hand, the screening rate in the present study can be considered relatively low when considering the fact that the individuals over the age of 50 years account for approximately 20–23% of the population of our country.[21]

Colorectal cancer occurs more often in the left colon (including the rectum),[22] although a trend has been observed in the right colon in recent years.[23] Consistent with literature, the present study detected 82.6% of polyps and 91.7% of cancers in the left colon. Previous studies have reported 5–10% of those aged 20–79 years in the United States and 11.7% of those aged 30–70 years in the Netherlands have at least one first-degree relative with colorectal

cancer.[24,25] The present study detected a family history in 15.8% of those undergoing colonoscopy, which is believed to be in line with the literature, given the relatively more specific group.

According to ASGE, a considerable number of colonoscopies are performed for inappropriate indications.[26] The study by Burnand et al. suggested that patient characteristics failed to explain the differences in appropriateness and the performance of screening colonoscopies between centers, and that the use of screening colonoscopies under appropriate indication criteria enhanced procedural efficiency.[18] In meta-analysis conducted by Hassan C et al.,[27] it was reported that the most popular guidelines (ASGE and EPAGE) being followed today fail to identify colorectal cancer patients who do not meet the appropriate indication criteria, and voiced concerns over the use of such guidelines in current clinical practice. Colonoscopy for inappropriate indications has been reported to be more cost effective when compared to the cost of a potential case. In contrast, Bohara et al.[28] found appropriate indications for colonoscopy to be associated with high positive findings, suggesting that the use of guidelines prevents unnecessary procedures. In another paper by Hassan C et al.,[29] it was reported that the cancer detection rate with colonoscopy for an inappropriate indication was 1.9%, while the rate of colonoscopy for an inappropriate indication was 14–37%. According to ASGE, the rate of colonoscopy based on inappropriate indications is 22%.[26] We cannot claim that our center follows the guidelines to the letter in terms of indications for colonoscopy, as the approach of the physician and certain patient characteristics may, of course, change the spectrum of indications. We found that colonoscopy performed on approximately 2% (n=41) of the patients in our study were for indications that may not be in line with the guidelines, and two (approximately 0.2%) of these patients were detected to have adenomatous polyps. Although no cancer was detected in these patients who underwent the procedure for indications not identified in the guidelines, adenomatous polyps, as precursors for cancer, were detected. The retrospective study by Tee et al.[30] highlighted the detection of lesions to be low but not zero among patients who underwent colonoscopy five years after a negative colonoscopy. The strict implementation of the guidelines is controversial in this regard. The performance of the procedure for inappropriate indications may also be influenced by the socioeconomic, psychological and biological characteristics of the population, and extensive screening programs may be a solution to this issue.

Diagnostic yield, which is high in colonoscopies performed for indications of iron deficiency anemia and rectal bleeding, is increased in those over the age of 50 years.[31] Tumor detection rates are lower in patients with abdominal pain than in those with iron deficiency anemia and rectal bleeding.[32-34] In the present study, rectal bleeding and constipation were the leading indications for colonoscopy, with the two indications accounting for the two-thirds of the total. Although not to a statistically significant degree, GIS bleeding and anemia were the most common indications among those identified with cancer.

A history of colorectal cancer or polyp detection on colonoscopy is an important risk factor for colorectal cancer development; while the histological structure, size and number of polyps are risk factors for the development of metachronous cancer. Polyp or cancer detection is more common in follow-up colonoscopies following a diagnosis of colorectal polyps or cancer, and so those diagnosed with polyps or cancer should undergo a follow-up colonoscopy. Those detected with advanced adenomas or serrated adenomas are at the highest risk of cancer development. The risk increases and the recommended follow-up interval changes with polyp type and increasing diameter or cancer stage.[27,35,36] According to the EPAGE II (5) study, the incidence of metachronous cancer and metachronous polyps at follow-up is 1–25% (mean: 7.6) and 6–40% (mean: 17.2), respectively. According to the US Multi-Society Task Force on Colorectal Cancer study,[36] colorectal cancer is detected in one of every 157 colonoscopies at follow-up after curative surgery for colorectal cancer, and most lesions are detected within the first 36 months. The present study detected metachronous cancer at follow-up in three patients after cancer and in two patients after polyp detection. In the present study, a higher rate of metachronous lesion detection was reported, with 46.3% (71/153), while the metachronous cancer rate was 4.7% (3/63), which is consistent with literature. Most other lesions were polyps, which may be attributed to our relatively low number of follow-up colonoscopies, and should also serve as a warning of the danger of missing polyps during colonoscopy procedures.

The rates reported in colonoscopy screening studies vary from 4.9% to 8.6% for advanced adenoma detection, and from 14.9% to 37.5% for any adenoma or cancer detection.[37] Corley et al.[38] reviewed 314.872 colonoscopy procedures, and found the polyp detection rate (PDR) to vary between 7.5% and 52%, and the authors further re-

ported an interval cancer detection of 4.8–9.8 during the follow-up of 10.000 patients per year. The EPAGE study[40] determined a PDR of 12.5%, while the meta-analysis by Hassan et al.[29] found the cancer detection rate and adenomatous polyp detection rates to be 4.4% and 14.7%, respectively. Rulyak et al. identified an interval cancer rate of 2.8% among patients detected with colorectal cancer.[39] The interval cancer rate (<1%) established in the present study was quite low when compared to literature.

Tubular adenomas have a rate of 80% among all polyp types, while the rate of tubular adenomas was 72.3% in the present study, which is similar to literature.[40,41] An adenoma is considered advanced when greater than 1 cm, or when exhibiting a villous structure or high-grade dysplasia. Low- or high-grade dysplasia can be noted in all adenomas, and is the middle stage in the development of a polyp into cancer.[40-42] Adenomas account for two-thirds of all polyps,[43] and so the rate (65.5%) established in the present study can be considered consistent with literature.

It is reported that the desired cecal intubation rate is ≥95% and the acceptable rate is ≥90% in patients scheduled for total colonoscopy.[44, 45] Adenomatous polyp detection rate, cecal intubation rate and colonic inspection times are among the quality metrics. According to the US Multi-Society Task Force, a high-quality colonoscopy should involve a cecal intubation rate of ≥95%, minimum fecal debris and a retrograde colonic inspection of the cecum lasting 6–10 minutes.[36] Faminski et al.[46] identified a significantly higher likelihood of development of interval cancer when the polyp detection rate was 20% and below, and suggested a polyp detection rate of ≥20% to be a quality indicator for endoscopy. The ADR and Cancer Detection Rate (CDR) found in the present study are close to the values reported in literature, while the estimated interval cancer rates are similar to the literature.

The Poland study reports an ADR of ≤20% to be associated with a 10 times or more interval cancer detection.[48] In Corley et al.'s[38] comparison of 33.5% and 19% ADRs, it was found to be an independent risk factor for interval cancer, and an increase of 1% in ADR in particular was noted to result in a decrease of 3% in interval cancer. Tjaden et al.[47] considered the criterion for a high-quality colonoscopy to be 25% ADR. The ADR and PDR identified in the present study are similar to those reported in literature, although our rates can be considered low considering the criteria for high-quality colonoscopy. Unexpectedly, despite the low ADR and PDR values, the interval cancer rate in the present study was considerably lower than that reported in literature. We believe that this may be a result of our decision to apply colonoscopy for a wide range of indications.

Colonoscopic examination is the optimum approach to the detection, follow-up and treatment of colorectal cancer or its precursors. Considering the parameters used to establish the yield and quality of the procedure, the ADR-PDR and the interval cancer rates in literature, we believe some behavioral changes may take place around the world. The present study will serve as a guide for prospective studies.

Disclosures

Ethichs Committee Approval: The study was approved by the Local Ethics Committee. (Malatya Training and Research Hospital, 25.06.2019/8941).

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