Journal for ReAttach Therapy and Developmental Diversities
eISSN: 2589-7799
2022 December; 5 (2s): 381-393

Factors Affecting Colorectal Cancer in Korean: A Population-Based Study

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Received: 16-September-2022
Revised: 12-November-2022
Accepted: 11-December-2022

Abstract

This study aimed to classify the anatomical regions where colorectal cancer occurred into colon and rectum, to examine clinical characteristics, and to identify factors affecting colon cancer. The subject of this study was 2,756 cases of colorectal cancer in Korea registered in 2016. All data were analyzed using SPSS 23.0. In the clinical characteristics analyzed separately for colon cancer and rectal cancer, gender, age, morphology code (M-code), tumor size, distant metastasis, Surveillance, Epidemiology and End Result (SEER) stage, and cancer stage were statistically significant. Colon cancer was more common in women (65.6%) and rectal cancer was more common in men (43.6%) ($p < 0.001$). The incidence of colon cancer was higher in patients aged 80 years or older and that of rectal cancer was higher in patients younger than 49 years of age ($p < 0.001$). The results of logistic regression analysis showed that the incidence of colon cancer in female patients was 1.42 times ($p < 0.001$) that in males. In comparison with the incidence in patients aged 49 years and younger, the incidence of colon cancer was 1.59 times ($p = 0.002$) in those aged 70 to 79 years and 1.95 times ($p < 0.001$) in those aged over 80 years. The incidence of colon cancer was 18.14 times ($p < 0.001$) higher in the absence of distant metastasis than in cases with distant metastasis. In comparison with the incidence of SEER stage localized disease, the incidence of regional disease (direct invasion + lymphatic invasion) was 0.17 times lower ($p < 0.001$) and that of distant disease was 0.08 times lower ($p = 0.001$). In comparison with the incidence of stage 1 disease for colon cancer, the incidence of stage 2 disease was 1.56 times higher ($p < 0.001$), and that of stage 4 disease was 1.32 times higher ($p = 0.026$). In the predictive model of factors affecting the incidence of colon cancer, colon cancer stage sequentially affected SEER stage → gender → age and tumor size. Thus, although colon cancer and rectal cancer are anatomically classified as large intestine cancers, the clinical characteristics of both cancers are clearly different, and prophylactic, diagnostic, and therapeutic approaches for the two disease entities should differ accordingly.

Keywords: Colorectal cancer, Colon cancer, Rectal cancer, Clinical characteristics Oncology, Health promotion

1. INTRODUCTION

Colorectal cancer is the third-most common cancer worldwide after lung cancer and breast cancer and has the second-highest mortality rate after lung cancer [1]. Approximately half of all colorectal cancer cases can be prevented through interventions targeting risk factors [2]. In addition, secondary prevention through fecal occult blood tests and colonoscopy examinations can reduce the mortality rate as well as the incidence rate by removing precancerous lesions such as polypsAccording to the national cancer registration project report, the number of colorectal cancer cases in 2019 was 29,030, accounting for 11.4% of the domestic cancer incidence and making it the fourth-most common cancer in the country [3]. The incidence of colorectal cancer remains high despite advances in early detection and diagnosis through screening tests and treatment technologies. Although colorectal cancer is more common among older people [4], the rate of diagnosis of colorectal cancer among young people has been increasing recently [5]. In comparisons of countries around the world, Korea (44.5/100,000) showed the second-highest incidence of colorectal cancer in 2018 after Hungary (51.2/100,000) [6-7]. The average age of onset of colorectal cancer is in the late 60s, and approximately 90% or more of the cases involve patients aged over 50 years [7-8]. Despite the opinion that an increase in the incidence of colorectal cancer due to an increase in risk factors will be offset by early diagnosis and treatment of precancerous lesions through screening tests for people over 50 years of age [9], in North America, Europe, and Australia, the incidence of colorectal cancer among young people is increasing and the disease is emerging as an important public health problem [10].

Colorectal cancers occurring in the colon and rectum are called colon cancer and rectal cancer, respectively [11]. The large intestine is anatomically divided into the colon and rectum, and the clinical characteristics of both organs are somewhat different. In GLOBOCAN 2018 proposed by the International Agency for Research on Cancer (IARC), the types of cancers were expanded to 36, and colon cancer and rectal cancer were presented separately [12]. The colon is approximately 1.5 m long from the cecum and is divided into the ascending colon, transverse colon, descending colon, and s-colon on the right side of the abdomen connected to the cecum. On the other hand, the rectum is an organ between the sigmoid colon and anus, and its length is about 15 cm. The main symptoms of colon cancer include loss of appetite, indigestion, anemia, and weight loss. However, the most common symptom of rectal cancer is hematochezia. As for treatment method, the treatment of colon cancer is based on surgery with adjuvant chemotherapy. Among colon cancers, except for sigmoid colon cancer, local recurrence is rare, so radiation therapy is usually not indicated. However, rectal cancer is divided into upper, middle, and lower parts by dividing the 15-cm length into parts of approximately 5 cm each. For rectal cancer that occurs in the upper and middle parts, anal function can be preserved, and surgery is performed first, but if the tumor is large, radiation or chemotherapy may be administered initially and followed by surgery. Surgery to remove the anus is generally applied to lower rectal cancer, but with advancements in medical technologies such as laparoscopic surgery and robotic surgery, a permanent artificial anus is rarely required, except when cancer cells invade the anus sphincter [11]. As such, colon cancer and rectal cancer are different forms of colorectal cancer in terms of symptoms, diagnosis, treatment methods, and prognosis.

Therefore, the purpose of this study is to divide the anatomical regions where colorectal cancer occurs into colon and rectum to examine the clinical characteristics of each, and to identify the clinical differences between colon cancer and rectal cancer through factors affecting colon cancer.

2. METHOD

2.1 Research Subjects

This study was conducted using cancer patient data registered in the collaborative stage data collected by the Korea Central Cancer Registry (KCCR). The cancer patient data collaborative stage research project is a project covering all cancer patients in Korea with the aim of evaluating the possibility of introducing a domestic cancer registration system. The collaborative stage research project has assigned priority to major cancers such as stomach, colorectal, and breast cancer [Table. 1] [3]. This study analyzed 2,756 cases of colorectal cancer in Korea registered in the collaborative stage research project in 2016. In this study, colorectal cancer included colon cancer (C18) and rectal cancer (C19-C20).

Table 1: Collaboration stage based on TNM

Cancer	T-code	M-code
Stomach*	C16.1-C16.6, C16.8-C16.9	8000-8152, 8154-8231, 8243-8245, 8247, 8248,8250-8576, 8940-8950, 8980-8990
Colon†	C18.0, C182.-C18.9	8000-8152, 8154-8231, 8243-8245, 8247, 8248,8250-8576, 8940-8950, 8980-8981
Rectosigmoid junction	C19.9	8000-8152, 8154-8231, 8243-8245, 8247, 8248,8250-8576, 8940-8950, 8980-8981
Rectum	C20.9	8000-8152, 8154-8231, 8243-8245, 8247, 8248,8250-8576, 8940-8950, 8980-8981
Breast	C50.0-C50.6, C50.8-C50.9	8000-8576, 8940-8950, 8980-8981, 9020
* Include: esophagus GE Junction †Exclude: appendix(C181)		

2.2 RESEARCH TOOLS

2.2.1 Clinical Characteristics

Clinical characteristics included in the study analysis were gender, age, morphology code (M-code), degree of differentiation, tumor size, presence or absence of regional lymph node metastasis, distant metastasis, Surveillance, Epidemiology and End Results (SEER) stage, and stage. The patients were divided into those aged 49 years or younger, 50-59 years, 60-69 years, 70-79 years, and 80 years or older. The M-codes M8140-M8384 were classified as adenocarcinoma, and other morphology codes were categorized as other. Tumor differentiation was categorized as well, moderate, poorly, and unknown. Tumor size was classified into <2.0 cm, 2.0-4.9 cm, 5.0-6.9 cm, ≥7.0 cm, and unknown. Regional lymph node invasion and distant metastasis were classified as present, absent, and unknown. SEER stages were classified into localized, regional direct, regional lymph, regional direct & lymph, distant, and unknown. The cancer stages were divided into I-IV and unknown andused in the analysis of this study.

2.2.2 Anatomical Area

Colorectal cancer was divided into colon cancer (C18) and rectal cancer (C19-C20), and the clinical characteristics and risk factors of each type of cancer were predicted [Table. 2].

Table 2: Classification of anatomical regions of colorectal cancer

T-code	n=2,756	%		Classification	X^2(p)
C18.0	117	4.2	1,657(60.1)	Colon ca	2756.000 (.000)
C18.2	385	14.0			
C18.3	83	3.0			
C18.4	118	4.3			
C18.5	17	.6			
C18.6	77	2.8			
C18.7	772	28.0			
C18.8	14	.5			
C18.9	74	2.7			
C19.9	256	9.3	1,099(39.9)	Rectal ca	
C20.9	843	30.6			

Note: C18.0 cecum/ C18.2 ascending colon / C18.3 hepatic flexure/ C18.4 transverse colon/ C18.5 splenic colon/C18.6 descending colon/ C18.7 sigmoid colon/ C18.8 overlapping lesion of colon/ C18.9 unspecified colonC19.9 rectosigmoid colon/ C20.9 rectum

2.3 Data Analysis

All data were analyzed using SPSS 23.0. The clinical characteristics and prognosis of colorectal cancer were compared. The patients were divided into colon cancer and rectal cancer groups, and the findings for the two groups were compared by chi-square test. In addition, the factors influencing colon cancer were predicted through logistic regression analysis and a decision-making tree model.

3. CLINICAL CHARACTERISTICS OF COLORECTAL CANCER

3.1 Distribution of Clinical Characteristics of Colorectal Cancer

The [Table. 3] shows the results of analysis of the clinical characteristics of colorectal cancer. The rate of colorectal cancer in male patients (59.5%) was almost 20% higher than that in female patients (40.5%). In evaluations based on age group, the highest incidence was observed in patients aged 70-79 years (28.8%), followed by those aged 60-69 years. As for the M-code, M8140-8384 (adenocarcinoma) accounted for most

cases (94.1%), and the degree of differentiation was moderate at 72.2%. The most common tumor size was between 2.0-4.9 cm (30.4%), followed by 5.0-6.9 cm. Regional lymph node invasion did not occur in 41.3% and did occur in 32.4%. Distant metastases did not occur in 80.4% of the case but occurred in 17.7%. The SEER staging indicated localized type in 28.6% of the cases, regional (direct + lymph) type 23.8% of the cases, and distant type in 18.8%. Cancer stage was stage III (32.6%), followed by stage I (24.2%).

Table 3: Distribution of clinical characteristics of colorectal cancer

Classification		**n**	**%**
Gender	Male	1,641	59.5
	Female	1,115	40.5
Age	≤49 years	262	9.5
	50-59 years	565	20.5
	60-69 years	742	26.9
	70-79 years	795	28.8
	≥80 years	392	14.2
M-code	M8140-M8384	2,594	94.1
	Other types	162	5.9
Differentiation	Well	430	15.6
	Moderate	1,990	72.2
	Poorly	129	4.7
	Unknown	207	7.5
Tumor size	< 2.0 cm	156	5.7
	2.0-4.9 cm	837	30.4
	5.0-6.9 cm	675	24.5
	> 7.0 cm	615	22.3
	Unknown	473	17.2
Regional LN node invasion	Yes	892	32.4
	No	1,138	41.3
	Unknown	726	26.3
Distant metastasis	Yes	487	17.7
	No	2,215	80.4
	Unknown	54	2.0
SEER[1)] stage	L	788	28.6
	RE	504	18.3
	RN	218	7.9
	RE+RN	655	23.8
	D	518	18.8
	Unknown	73	2.6
Cancer stage	I	667	24.2
	II	613	22.2
	III	898	32.6
	IV	487	17.7
	Unknown	91	3.3

Note 1) L: Localized
RE: Regional, direct extension
RN: Regional, lymph nodes
RE+RN: Regional, extension and nodes
D: Distant

3.2 Comparison of Clinical Characteristics of Colorectal Cancer

The [Table. 4] shows the results of cross-analyses of the clinical characteristics of colon cancer and rectal cancer. Gender, age, M-code, tumor size, distant metastasis, SEER stage, and cancer stage showed statistically significant differences. The incidence of colon cancer was higher in women (65.6%) than in men (56.4%), but the incidence of rectal cancer was higher in men (43.6%) than in women (34.4%). The differences were statistically significant ($p< 0.001$). As for age, the incidence of colon cancer was the highest in patients aged over 80 years, followed by those aged 70-79 years. The incidence of rectal cancer was the highest among those under 49 years of age, followed by those aged between 60 and 69 years of age, and the difference was statistically significant ($p< 0.001$).

As for M-code, colon cancer was more frequently observed in cases involving other type codes (74.1%) rectal cancer more frequently involved cases with adenocarcinoma codes (40.7%), and the difference was statistically significant ($p< 0.001$). In terms of tumor size, colon cancer most frequently involved tumors of 7 cm or more (67.6%), followed by tumors less than 2 cm in size (60.5%). Rectal cancer most frequently involved tumors of 5.0-6.9 cm (41.9%), followed by tumors 2.0-4.9 cm in size (39.7%), and the difference was statistically significant ($p< 0.001$).

In colon cancer, distant metastasis occurred in many cases (65.1%), and in rectal cancer, distant metastasis did not occur in many cases (40.9%), and the difference was statistically significant ($p= 0.046$). In SEER staging, colon cancer showed the highest rate of distant type (63.9%), while rectal cancer showed the highest rate of regional (direct + lymph) type (47.5%), and the difference was statistically significant ($p< 0.001$). As for cancer stage, colon cancer showed the highest incidence of stage II (68.8%), while rectal cancer showed the highest incidence of stage III (47.0%), and the difference was statistically significant ($p< 0.001$).

Table 4: Comparison of clinic characteristics of colorectal cancer

Classification		**Cancer**		**Total**	**X^2(p)**
		Colon	**Rectum**		
Total		1,657(60.1)	1,099(39.9)	2756(100.0)	
Gander	Male	926(56.4)	715(43.6)	1641(100.0)	23.090 (.000)
	Female	731(65.6)	384(34.4)	1115(100.0)	
Age	≤49 years	139(53.1)	123(46.9)	262(100.0)	25.435 (.000)
	50-59 years	328(58.1)	237(41.9)	565(100.0)	
	60-69 years	417(56.2)	325(43.8)	742(100.0)	
	70-79 years	507(63.8)	288(36.2)	795(100.0)	
	≥80 years	266(67.9)	126(32.1)	392(100.0)	
M-code	M8140-M8384	1,537(59.3)	1,057(40.7)	2594(100.0)	13.972 (.000)
	Other types	120(74.1)	42(25.9)	162(100.0)	
Differentiation	Well	268(62.3)	162(37.7)	430(100.0)	4.451

	Moderate	1,173(58.9)	817(41.1)	1990(100.0)	(.217)
	Poorly	83(64.3)	46(35.7)	129(100.0)	
	Unknown	133(64.3)	74(35.7)	207(100.0)	
Tumor size	< 2.0 cm	96(61.5)	60(38.5)	156(100.0)	27.503 (.000)
	2.0-4.9 cm	505(60.3)	332(39.7)	837(100.0)	
	5.0-6.9 cm	392(58.1)	283(41.9)	675(100.0)	
	> 7.0 cm	416(67.6)	199(32.4)	615(100.0)	
	Unknown	248(52.4)	225(47.6)	473(100.0)	
Regional LN node invasion	Yes	542(60.8)	350(39.2)	892(100.0)	.869 (.648)
	No	689(60.5)	449(39.5)	1,138(100.0)	
	Unknown	426(58.7)	300(41.3)	726(100.0)	
Distant metastasis	Yes	317(65.1)	170(34.9)	487(100.0)	6.155 (.046)
	No	1,309(59.1)	906(40.9)	2215(100.0)	
	Unknown	31(57.4)	23(42.6)	54(100.0)	
SEER[1)] stage	L	501(63.6)	287(36.4)	788(100.0)	27.748 (.000)
	RE	319(63.6)	185(36.7)	504(100.0)	
	RN	119(63.3)	99(45.4)	218(100.0)	
	RE+RN	344(52.5)	311(47.5)	655(100.0)	
	D	331(63.9)	187(36.1)	518(100.0)	
	Unknown	43(58.9)	30(41.1)	73(100.0)	
Cancer stage	I	391(58.6)	276(41.4)	667(100.0)	44.680 (.000)
	II	422(68.8)	191(31.2)	613(100.0)	
	III	476(53.0)	422(47.0)	898(100.0)	
	IV	317(65.1)	170(34.9)	487(100.0)	
	Unknown	51(56.0)	40(44.0)	91(100.0)	

Note 1) L: Localized

RE: Regional, direct extension

RN: Regional, lymph nodes

RE+RN: Regional, extension and nodes

D: Distant

4. FACTOR EXPLORATION OF COLON CANCER

4.1 Influencing Factors According To the Clinical Characteristics of Colon Cancer

Logistic regression analysis was performed to determine the factors affecting clinical characteristics according to the presence of colon cancer [Table. 5]. The factors influencing colon cancer were gender, age, M-code, distant metastasis, SEER stage, and cancer stage. In comparisons based on gender, women were 1.42 times ($p < 0.001$) more likely to develop colon cancer than men. In comparison with the incidence in patients aged ≤49 years, the colon cancer was 1.33 times ($p= 0.065$) in aged 50-59 years and 1.16 times ($p = 0.863$) in those aged 60-69 years, but the difference was not statistically significant. Subjects aged 70-79 years were 1.59 times ($p = 0.002$) and those aged over 80 years were 1.95 times ($p < 0.001$) more likely to develop colon cancer, the difference was statistically significant.

In comparison with the incidence of adenocarcinoma codes (M8410-M8384) in M-code, other type codes were 2.12 times ($p< 0.001$) more likely to develop colon cancer. In comparison with the incidence of colon cancer in distant metastasis, the incidence rate of colon cancer without distant metastasis was 18.14 times higher ($p < 0.001$). In comparison with the incidence of colon cancer in localized of SEER stage, regional type (direct invasion) was 0.17 times ($p < 0.001$), and regional type (lymph invasion) was 0.20 times ($p = 0.001$) more likely to result in colon cancer. While regional type (direct invasion + lymphatic invasion) was 0.18 times ($p = 0.001$), and distant type was 0.08 times ($p < 0.001$) times less likely to develop colon cancer. In comparison with the incidence of colon cancer in cancer stage I, stage II was 1.56 times ($p<0.001$), and stage IV 1.32 times ($p= 0.026$) more likely to result in colon cancer. While stage III was 0.80 times ($p= 0.027$) less likely to develop colon cancer.

Table 5: Influencing factors according to the clinical characteristics of colon cancer

Classification		B	S.E,	P-value	Exp(B)	95% CI
Gender	Male				1.000	
	Female	.348	.084	.000	1.416	1.200-1.671
Age	≤49 years				1.000	
	50-59 years	.287	.155	.065	1.332	.983-1.806
	60-69 years	.146	.150	.329	1.157	.863-1.552
	70-79 years	.465	.149	.002	1.592	1.189-2.132
	≥80 years	.669	.171	.000	1.953	1.397-2.731
Morphology	M8140-M8384				1.000	
	Other types	.750	.197	.000	2.117	1.440-3.112
Tumor size	< 2.0 cm				1.000	
	2.0-4.9 cm	-.104	.187	.577	.901	.625-1.299
	5.0-6.9 cm	-.292	.203	.151	.747	.501-1.112
	> 7.0 cm	.183	.205	.374	1.200	.803-1.795
	Unknown	-.668	.211	.002	.513	.339-.775
Distant metastasis	Yes				1.000	
	No	2.898	.537	.000	18.140	6.336-51.938
	Unknown	-.209	.442	.636	.811	.341-1.929
SEER[1)] stage	L				1.000	
	RE	-1.781	.335	.000	.168	.087-.325
	RN	-1.602	.503	.001	.201	.075-.540

	RE+RN	-1.699	.496	.001	.183	.069-.483
	D	-2.499	.521	.000	.082	.030-.228
	Unknown	-.622	.709	.381	.537	.134-2.156
Cancer stage	I				1.000	
	II	.444	.117	.000	1.560	1.239-1.963
	III	-.228	.103	.027	.796	.650-.975
	IV	.275	.123	.026	1.316	1.034-1.676
	Unknown	-.105	.225	.640	.900	.579-1.400

Note 1) L: Localized
RE: Regional, direct extension
RN: Regional, lymph nodes
RE+RN: Regional, extension and nodes
D: Distant

4.2 PREDICTION OF FACTORS AFFECTING COLON CANCER

The decision-making tree CART method was used to predict the influencing factors of colon cancer. The factors of the corresponding node from the root (node 0) to the tip (node N) of the decision-making tree and the separation criteria accordingly are presented in [Fig. 1] and [Fig. 2]. The factors affecting colon cancer were cancer stage, tumor size, SEER stage, gender, and age.

More specifically, stage II and stage IV (Node 1) showed a prediction rate of 67.2% for colon cancer cases. cancer stage affects the SEER stage, and the regional (direct invasion), regional (lymph invasion), and regional (direct invasion + lymph invasion) (Node 4) SEER stages showed a prediction rate of 64.4% for colon cancer. The SEER stage affects gender. By gender, Female (Node 7) showed a prediction rate of 71.8% for colon cancer, while male (Node 8) showed a prediction rate of 59.5% for colon cancer. The female affect age. Thus, patient age ≤ 49 years and 70-79 years (Node 13) showed a prediction rate of 65.4% for colon cancer. The Male affect tumor size. The prediction rate of colon cancer for tumors over 7 cm (Node 15) was 72.3%, while the prediction rate for all sizes (Node 16) except for tumors larger than 7 cm in size was 54.5%. Age ≤ 49 years and 70-79 years (Node 13) also affected the tumor size. The prediction rate of colon cancer for tumor size < 2.0 cm, 2.0-4.9 cm, and > 7.0 cm (Node 21) was 74.7%. The tumor size (Node 15 and Node 16) affected age [Fig. 1].

On the other hand, [Fig. 2] shows that the prediction rate of colon cancer for stage I and III (Node 2) was 55.4%. The cancer stage affects tumor size. The prediction rate of colon cancer for tumor size unknown (Node 5) was 58.6%, and that for all other sizes (Node 6) was 57.8%. The tumor size "unknown" affected SEER stage. The prediction rate of no colon cancer for SEER stage was regional (direct invasion + lymph invasion), regional (lymph invasion), and distant (Node 9) 76.4%. All sizes (Node 6), except "unknown" tumor size, affect age. The prediction rate of colon cancer for age over 70 years (Node 12) was 64.1%. The SEER stage regional (direct invasion + lymph invasion), regional (lymph invasion), and distant (Node 9) affect age. Thus, prediction rate of colon cancer for patient age ≤ 49 years, 50-59 years, and 60-69 years (Node 17) was 92.6%. The SEER stage localized, regional (direct invasion), and unknown stage (Node 10) affects gender. The prediction rate of colon cancer for female (Node 19) was 61.0% [Fig. 2].

The following is the risk chart for evaluating the model predicting the factors influencing colon cancer [Table. 6]. In the logistic regression analysis, the risk estimate of this model was 0.411, the standard error (SE of risk estimate) was 0.039, and the classification accuracy was 63.4%. For the decision-making tree, the risk estimate was 0.377, the SE was 0.009, and the classification accuracy was 62.3%.

Figure 1: Decision-making tree of C&RT model 1

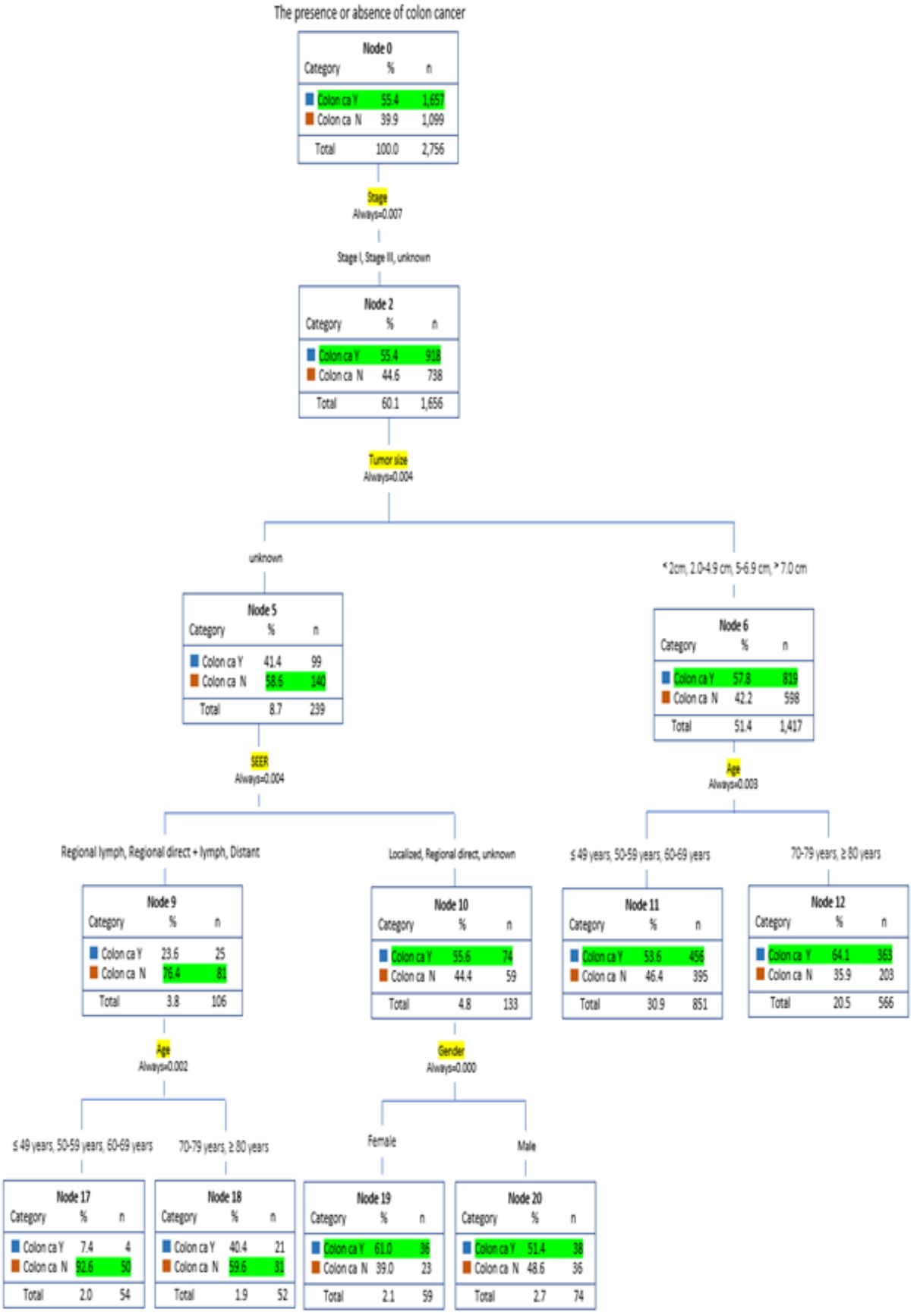

Figure 2: Decision-making tree of C&RT model 2

Table 6: The prediction rate of logistic regression model and decision-making tree model

Observed				Prediction Category				Risk Estimate	SE of risk Estimate
				Colon ca		Total	Predicted ratio		
				Yes	No				
Logistic regression	Actual category	Colon ca	Yes	1,440	217	1,657	86.9	.411	.039
			No	791	308	1,099	28.0		
Total				2,231	525	2,045	63.4		
Decision-making tree	Actual category	Colon ca	Yes	1,528	129	1,657	92.2	.377	.009
			No	910	189	1,099	17.2		
Total				2,438	318	2,756	62.3		

5. DISCUSSIONS

This study predicted factors affecting the incidence of colon cancer in relation to the clinical characteristics analyzed by dividing 2,756 cases of colorectal cancer in this study into colon cancer and rectal cancer. The main research results are as follows.

Colon cancer and rectal cancer showed a clear difference in terms of demographics. Colon cancer was more common in women (65.6%) and 1.42 times more common in women than men. On the other hand, rectal cancer was more common in men (43.6%). In women, the rate of colon cancer was higher than that in men, which can be explained by the association of the developmental mechanism of colon cancer with female hormones [13]. In Korea, in the past, rectal cancer accounted for more than half of all colorectal cancers, but the distribution of colon cancer has been gradually changing [13]. Although the association with risk factors differs depending on the specific region, smoking shows a stronger association with rectal cancer than with colon cancer [14]. The incidence of colon cancer was higher in those over 80 years of age, and the incidence of rectal cancer was higher in those younger than 49 years of age. In comparison with the incidence of colon cancer in patients aged 49 years and younger, the incidence was 1.59 times higher in those aged 70-79 years and 1.95 times higher in those aged 80 years and older. Although the incidence of colorectal cancer is traditionally known to increase with age, an increase in the incidence of colon cancer under the age of 50 has been reported in Europe, Denmark, New Zealand, and the United Kingdom [15]. In Asia, Taiwan, Japan, and Hong Kong have shown an increase in the incidence of colorectal cancer in patients aged under 50 years [16]. As such, the number of young colorectal cancer patients under the age of 50 years is increasing. The main causes of this change are obesity and changes in eating habits [17]. The IARC suggested that ionizing radiation, alcohol, smoking, and processed meat intake as group 1 carcinogens are associated with colorectal cancer [15]. On the other hand, the World Cancer Research Fund (WCRF) cites alcohol consumption, processed meat intake, obesity, and tall height as risk factors for colorectal cancer [17] Among individuals with BMI over 25 kg/m^2, the risk of colon cancer was significantly higher only in men, while taller height increased the risk of colorectal cancer in both men and women [18]. In addition, in Korea, colorectal cancer screening is not recommended for people under the age of 50 years, so early screening and detection are difficult. Although the incidence of colorectal cancer has decreased in the United States, Canada, and Australia, where early colorectal cancer screening was introduced, the incidence increased in those under the age of 50 years, who were not included in the population to be screened [19-21].

The incidence of colon cancer was 18.14 times more likely to not result in distant metastases. The SEER staging showed a low probability of colon cancer in cases with regional (direct invasion + lymphatic invasion) and distant stages. Considering the anatomy and the location of the tumor, colon cancer shows a tendency to metastasize to the peritoneum [22]. This is thought to be because the chance of direct contact with the tumor increases during colon cancer surgery, and the tumor cells are artificially deprived [22]. However, the type of polyps found through early screening can be easily removed by submucosal resection and polypectomy rather than laparotomy, which is thought to reduce the incidence of distant metastases.

In the predictive model of factors affecting the incidence of colon cancer, the stage of colon cancer affected the SEER stage, which affected gender. The gender sequentially affected age and tumor size. On the other hand, when the stage of colon cancer affected the size of the tumor, The SEER stage and age were sequentially affected, and SEER stage influenced age and gender. Therefore, the most important influencing factor for colon cancer is the stage of the tumor, and early diagnosis and detection are the most important preventive measures. In addition, changes in diet and lifestyle, such as alcohol consumption, smoking, consumption of processed meat, and obesity, which have been identified as risk factors for colorectal cancer suggested in previous studies, should be prioritized, and accounted for in early screening.

6. CONCLUSION

In this study, colorectal cancer was classified into colon and rectal cancers, and the significant clinical characteristics of both types of cancers were identified using the raw data for colorectal cancer cases from the KCCR. This process aimed to reflect the clinical differences between colon cancer and rectal cancer in terms of prevention, early diagnosis, and treatment of the corresponding cancer. Although colon cancer and rectal cancer are anatomically classified as the large intestine, the clinical features and demographic characteristics of colon and rectal cancers are clearly different from each other, so both require distinct preventive, diagnostic and therapeutic approaches. In addition, a public health approach that reflects these different characteristics and a policy approach for health promotion are needed. The results of this study were conducted using national raw data and did not sufficiently reflect the major variables in the occurrence of colorectal cancer. In addition, additional studies that fully reflect the risk factors for colorectal cancer will be needed.

ACKNOWLEDGMENTS

This study was conducted with the assistance of Namseoul National University with the aim of decreasing the incidence of breast cancer in Korea.

FUNDING

The funding for this paper was provided by Namseoul University, Chungnam, South Korea.

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