Research Article

Prognostic Factors and Survival Analysis after Radical Surgery in Elderly Patients with Colorectal Cancer Based on SEER Database

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Abstract

Background: The postoperative survival time and prognosis of elderly patients with colorectal cancer are influenced by numerous factors. This study analyzes these factors to provide references for clinical prognostic evaluation. *Methods*: Elderly patients who underwent radical surgery for colorectal cancer were selected from the SEER database. Their data were analyzed using the COX proportional hazards model and the Kaplan-Meier method. *Results*: The study included 6031 patients, among whom 2902 were male (48.12%) and 3129 were female (51.88%). The racial composition included 4694 Whites (77.83%), 603 Blacks (10.00%), and 734 Asians and other races (12.17%). There were 1440 patients aged 65-69 years (23.88%), 1382 aged 70-74 years (22.91%), 1185 aged 75-79 years (19.65%), 1082 aged 80-84 years (17.94%), and 942 aged over 85 years (15.62%). The median survival time for elderly patients who died post-surgery was 49 months, with a 1-year survival rate of 92.42%, a 2-year survival rate of 86.13%, a 3-year survival rate of 68.65%, a 4-year survival rate of 51.27%, and a 5-year survival rate of 34.96%. Univariate analysis indicated that age, race, extent of tumor metastasis, tumor stage, and TNM stage were related factors influencing postoperative prognosis. The COX proportional hazards model analysis showed that age and race were independent risk factors for postoperative prognosis. Patients older than 75 years had a poorer prognosis post-surgery. Among racial groups, Whites had a longer survival period compared to Blacks. Stratified analysis revealed that for patients with local metastasis, both age and race were influential factors for prognosis, while for patients with distant metastasis, age was the influencing factor. Interaction analysis of different factors indicated that patients over 85 years of age who were either Asian or from other races, those over 85 years of age with distant tumor metastasis, and those aged 85 or older with stage IV tumors had a poorer prognosis. *Conclusion*: Age and race are independent risk factors affecting the postoperative prognosis of elderly colorectal cancer patients. The impact of these factors varies with different levels of tumor metastasis. Thus, understanding the clinical characteristics of elderly colorectal cancer patients can provide evidence for optimizing postoperative treatment and improving prognosis.

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1. Introduction

Colorectal cancer is one of the most common malignant tumors worldwide, severely impacting health and longevity [1-3]. According to data released by the International Agency for Research on Cancer (IARC) of the World Health Organization, approximately 560,000 new cases of colorectal cancer were reported in China in 2020, leading to nearly 290,000 deaths [4]. Estimates from the American Cancer Society suggest that in 2020, only about 25.7% of colorectal cancer cases were diagnosed in individuals under the age of 50 [5]. With the global aging population on the rise, the prevalence of colorectal cancer in elderly patients is increasing [6]. The primary treatment for elderly colorectal cancer patients is radical surgery [7, 8]. However, various factors influence the long-term prognosis of these patients [9, 10]. Therefore, this study aims to analyze the clinical characteristics, survival time, prognostic risk factors, and variations in postoperative elderly colorectal cancer patients using data from the Surveillance, Epidemiology, and End Results (SEER) program of the National Cancer Institute and to provide references for clinical prognostic evaluation.

2. Materials and Methods

2.1. Subjects and Methods

We screened data from the SEER database from 2010 to 2015 and selected 6031 elderly colorectal cancer patients over the age of 65 who underwent radical surgery. These patients were categorized by race into Whites, Blacks, Asians, and others. The analysis of prognostic factors considered tumor differentiation, categorized into well-differentiated, moderately differentiated, poorly differentiated, and undifferentiated. The primary site of tumors was classified into the rectum, sigmoid colon, ascending colon, descending colon, and cecum. Tumor staging followed the seventh edition of the American Joint Committee on Cancer (AJCC) TNM staging system, with stages I, II, III, and IV. The extent of tumor metastasis was divided into local, regional, and distant metastasis. Overall survival time was defined as the time from surgery to death or the date of last follow-up.

2.2. Statistical Analysis

Data analysis was conducted using Stata 18.0 software. Chi-square tests were utilized to compare differences in proportions between groups. Kaplan-Meier methods were employed to plot survival curves, and Log-rank tests were used for univariate analysis. Statistically significant variables from the univariate analysis were included in a Cox proportional hazards regression model for multivariate analysis, accompanied by stratified analysis and interaction analysis of different factors. A P-value of less than 0.05 was considered to indicate statistical significance.

3. Results

3.1. Clinical Characteristics of Patients

All the screened elderly patients with colorectal cancer underwent radical surgery. Among the 6031 patients in this study, there are 2902 males (48.12%), 3129 females (51.88%), 4694 whites (77.83%), 603 blacks (10.00%), and 734 Asians and other races (12.17%). There were 1440 cases (23.88%) aged 65-69, 1382 cases (22.91%) aged 70-74, 1185 cases (19.65%) aged 75-79, 1082 cases (17.94%) aged 80-84, and 942 cases (15.62%)(Table 1)

Table 1. Clinical information of elderly patients with colorectal cancer.

Characteristics	N (%)
Age(years)	
65-69	1440(23.88)
70-74	1382(22.91)
75-79	1185(19.65)
80-84	1082(17.94)
≥85	942(15.62)
Gender	
Male	2902(48.12)
Female	3129(51.88)
Race	
Whites	4694(77.83)
Blacks	603(10.00)
Asians and other	734(12.17)

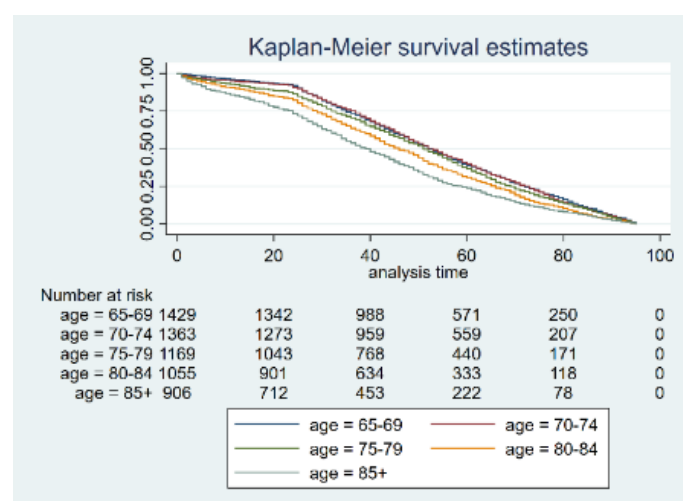| Characteristics	N (%)	Characteristics	N (%)
Extent of tumor metastasis		T2	2885(47.84)
Local	5993(99.37)	T3	15(0.25)
Regional	6(0.10)	T4	16(0.27)
Distant	32(0.53)	N stage	
Tumor stage		N0	6003(99.54)
I	5990(99.32)	N1	28(0.46)
II	6(0.10)	M stage	
III	4(0.07)	M0	6000(99.49)
IV	31(0.51)	M1	31(0.51)
T stage			
T1	3115(51.65)		

Figure 1. *Kaplan-Meier Survival Curves for Postoperative Elderly Patients with Colorectal Cancer by Age Group.*
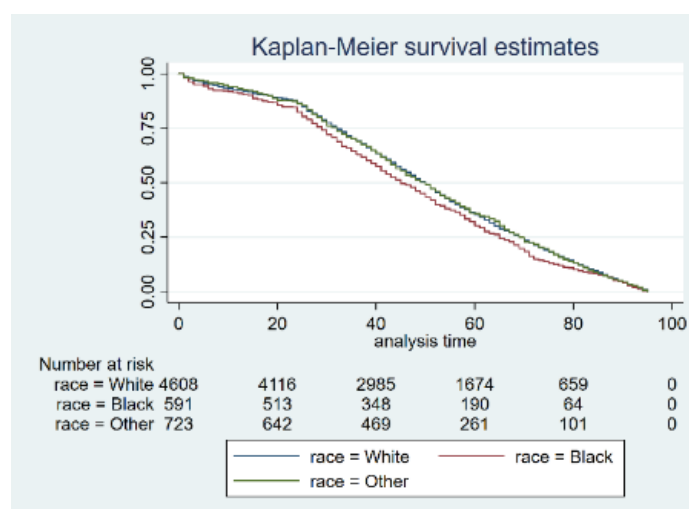

Figure 2. *Kaplan-Meier Survival Curves for Postoperative Elderly Patients with Colorectal Cancer by Race Group.*

3.2. Overall Survival Situation

The results of the Kaplan-Meier survival analysis indicated that the median survival time for all patients was 49 months, with a 1-year survival rate of 92.42%, a 2-year survival rate of 86.13%, a 3-year survival rate of 68.65%, a 4-year survival rate of 51.27%, and a 5-year survival rate of 34.96%. In terms of age groups, elderly colorectal cancer patients over the age of 75 had a poorer postoperative prognosis. When categorized by race, the survival time for White patients was better compared to Black patients (Figures 1 and 2).

3.3. Univariate and COX Analysis

The results of the univariate analysis using the Log-rank test showed that age, race, extent of tumor metastasis, tumor stage, and TNM staging were all relevant factors influencing the postoperative prognosis of elderly colorectal cancer patients (Table 2). Factors that showed statistical significance in the univariate analysis were further analyzed by multivariate analysis using the Cox regression model. The results of analysis revealed that age and race were independent risk factors affecting the postoperative prognosis of elderly colorectal cancer patients (Table 3).

Variables	n	χ^2	P
Tumor stage		32.15	<0.001
I	5990		
II	6		
III	4		
IV	31		
T stage		34.37	<0.001
T1	3115		
T2	2885		
T3	15		
T4	16		
N stage		17.65	<0.001
N0	6003		
N1	28		
M stage		30.78	<0.001
M0	6000		
M1	31		

Table 2. *Univariate Analysis of Postoperative Prognosis in Elderly Patients with Colorectal Cancer.*

Variables	n	χ^2	P
Age (years)		139.47	<0.001
65-69	1440		
70-74	1382		
75-79	1185		
80-84	1082		
≥85	942		
Gender		0.26	0.6072
Male	2902		
Female	3129		
Race		9.23	0.0099
Whites	4694		
Blacks	603		
Asians and other	734		
Extent of tumor metastasis		33.93	<0.001
Local	5993		
Regional	6		
Distant	32		

Table 3. *COX Analysis of Postoperative Prognosis in Elderly Patients with Colorectal Cancer.*

Variables	HR	95%CI	P
Age (years)			
65-69	1		
70-74	1.021	0.948-1.100	0.585
75-79	1.092	1.010-1.180	0.027
80-84	1.294	1.194-1.402	<0.001
≥85	1.547	1.422-1.684	<0.001
Race			
Whites	1		
Blacks	1.197	1.098-1.305	<0.001
Asians and other	1.045	0.966-1.131	0.271
Extent of tumor metastasis	2.141	0.636-7.207	0.219
Tumor stage	1.000	0.402-2.484	0.999
T stage	1.018	0.967-1.072	0.485
N stage	0.648	0.271-1.548	0.329
M stage	0.941	0.254-3.486	0.928

HR: hazard ratio

3.4. Stratified and Interaction Analysis

Stratified analysis based on the extent of tumor metastasis revealed that for patients with local metastasis, both age and race were independent risk factors affecting prognosis. For patients with distant metastasis, age was identified as the independent risk factor influencing prognosis (Table 4). Interaction analysis of different factors indicated that patients over 85 years of age who were either Asian or from other races, those over 85 years of age with distant tumor metastasis, and those aged 85 or older with stage IV tumors had a poorer prognosis (Table 5).

Table 4. Stratified analysis of Postoperative Prognosis in Elderly Patients with Colorectal Cancer.

Variables	Local metastasis		Distant metastasis	
	HR	*P*	HR	*P*
Age	1.110	<0.001	1.730	0.010
Race	1.041	0.034	0.738	0.325

Table 5. Interaction analysis of Postoperative Prognosis in Elderly Patients with Colorectal Cancer.

Variables	HR	95%CI	*P*
Age # Race			
≥85# Asians and other	1.606	1.226-2.104	0.001
Age#Extent of tumor metastasis			
≥85#Distant	7.286	2.270-23.278	0.001
Age#Tumor stage			
≥85# IV	7.292	2.272-23.399	0.001

4. Discussion

Colorectal cancer is one of the most prevalent diseases today, with approximately 1.2 million patients diagnosed worldwide each year, and over 600,000 patients dying either directly or indirectly from it [11]. The etiology of colorectal cancer involves multiple factors, including age, gender, family history, inflammatory bowel disease, smoking, excessive alcohol consumption, consumption of large amounts of red processed meat, obesity, and diabetes, indicating a collaborative effect of environmental, dietary, and genetic factors [12, 13]. The current primary treatment modalities for colorectal cancer include surgical intervention, neoadjuvant radiotherapy, and adjuvant chemotherapy, with surgery being the most common method. This includes open surgery, laparoscopic surgery, and robotic surgery [14]. Various factors influence the postoperative prognosis in elderly colorectal cancer patients [15, 16]. Studies have indicated that Body Mass Index (BMI) and tumor N-stage are independent risk factors for postoperative prognosis [17]; others have shown that prognosis is associated with the type of surgery [18]. Losurdo et al. [19] found that, apart from patients older than 80, gender significantly influences postoperative survival, with females faring better than males. In this study, age, race, extent of tumor metastasis, tumor stage, and TNM staging were identified as factors influencing postoperative survival time in elderly colorectal cancer patients. Incorporating significant factors into the COX proportional hazards model, age and race emerged as independent risk factors. Kaplan-Meier survival analysis revealed that patients older than 75 had poorer postoperative outcomes and significant racial disparities, differing from previous research possibly due to variations in age and racial compositions in the colorectal cancer cohort.

The location, size, extent of invasion, and metastasis of colorectal cancer determine the surgical approach and extent of resection, influencing postoperative prognosis [20]. Research indicates that younger patients with fewer underlying diseases and local metastasis have better postoperative outcomes than older patients with distant metastasis [21]. Stratified analysis in this study showed that for patients with local metastasis, age and race were independent prognostic factors, while for those with distant metastasis, age was the sole independent factor. Interaction analysis of various factors revealed poor prognosis in patients over 85 who are Asian or other races, those over 85 with distant tumor metastasis, and those aged 85 or older with stage IV tumors. This underscores the need for thorough evaluations of age, race, tumor site, and stage in elderly colorectal cancer patients, along with meticulous intraoperative exploration and efforts to improve resection rates and postoperative treatment, to enhance the quality of life following radical surgery in this demographic.

This study has limitations. Primarily, as a retrospective study, patient data were solely derived from the SEER database. Additionally, due to limited data access, the focus was on analyzing the impact of age, race, and metastasis level on survival, without examining differences in other treatment conditions and specific pathological information.

5. Conclusions

In summary, elderly colorectal cancer patients who are over 75 years old, are of black people, and present with distant metastases tend to have poorer postoperative prognoses. This study provides evidence-based support for the tailored treatment and prognosis evaluation of postoperative elderly colorectal cancer patients with different clinical characteristics. Therefore, in the future, it is important to not only focus on the

standardized treatment of elderly colorectal cancer patients but also to pay attention to individualized treatment to improve their prognosis.

Abbreviations

IARC	International Agency for Research on Cancer
SEER	Surveillance, Epidemiology, and End Results
AJCC	American Joint Committee on Cancer
HR	Hazard Ratio

Author Contributions

Bingqing Xu: Writing – review & editing, Writing – original draft, Methodology, Investigation, Formal analysis, Data curation, Conceptualization.

Bing Wang: Writing – review & editing, Writing – original draft, Investigation, Formal analysis, Data curation.

Yang Xiao: Resources, Project administration, Methodol ogy

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Daojun Li: Investigation, Data curation

Shijun Li: Investigation, Data curation

Guoliang Liu: Investigation, Formal analysis

Kezhi Shi: Investigation, Formal analysis

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Data Availability Statement

The data supporting the outcome of this research work has been reported in this manuscript.

Conflicts of Interest

The authors declare no conflicts of interest.

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