



Prognostic factors affecting overall survival in right colon cancer

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ABSTRACT

Background: The prognosis of patients who have carcinoma of the colon is dependent on several factors that are clinical, pathological, and biological. Adequate lymph node staging in patients with colon cancer is important for determining prognosis and planning further treatment. We aimed to determine what factors might predict survival in patients with right colon cancer.

Methods: Between 2007 and 2014, consecutive patients undergoing operation for adenocarcinoma of the right-sided colon were enrolled in this study. The following factors were analyzed with the Cox regression model: age, gender, localization of the tumor, recurrence, pTNM stage, removed and invaded lymph node status (MLN) and survival rate. Multivariate models were used to assess the adjusted effects and to explore the interaction between survival and other factors.

Results: A total of 56 (38,1%) men and 91 (61,9%) women, mean age being $61,8 \pm 15,9$ years, were included. The mean survival time was $46,5 \pm 43,2$ months. The mean LN number was $18,8 \pm 9,44$; MLN number was $2,66 \pm 5,13$. Age, total LN, MLN number and postoperative stage were significant in the univariate analysis for survival. Independent predictors of survival in multivariate analysis were age ($p=0,019$), postoperative stage ($p=0,039$), and MLN ($p=0,003$).

Conclusions: LN metastasis is a prognostic feature in patients by means of colon cancer. It could not be changed independent of a number of prognostic factors, such as age, but LN number was dependent on operation in right colon cancer surgery. LN yields have been linked to improved survival and its determination is reliant on both the surgeon and the pathologist.

Key words: Right colon cancer, survi, prognosis

Introduction

Colon cancer is treated by surgical resection and adjuvant chemotherapy should be added to the treatment regimen for patients with lymph node (LN) metastasis. Resection of the affected bowel segment and all of the associated draining lymph nodes of the primary blood supply to that segment should be performed [1]. The prognosis of patients is dependent on several factors,

such as the clinical, pathological and biological characteristics of the tumors. Spreading of the tumor in to the bowel wall and local lymph node involvement are the most important influential factors [2]. For that reason, sufficient lymph node staging of patients is important for determining prognosis and planning advanced treatment. The nodal statuses are stratified based on the amount of positive LN metastases. Therefore, previous

studies suggest that high case load and regular attendance at multidisciplinary meetings are associated with larger numbers of LNs isolated from samplings following surgery for colorectal cancer [3,4]. There are many arguments in the literature about the prognostic value of tumor location. The aim of this study was to determine what factors might predict survival in patients with right colon cancer.

Patients and Methods

Between 2007 and 2014, consecutive patients undergoing operation for adenocarcinoma of the right-sided colon at Gulhane Military Medical University were enrolled in this study. Patient information from our colorectal cancer database was evaluated retrospectively to explore long-term outcomes, such as overall survival and recurrence rate. A total of 1459 patients had colon cancer, and 147 (10%) had tumors of the right colon. The right part of the colon was defined as the colon up to the central point of the transverse colon. Computerized tomographic scan and endoscopy were used to confirm cancer of the right part of the colon. Patients with synchronous or with two primary cancers, prior malignancies, cancers interrelated to familial adenomatous polyposis or genetic nonpolyposis colorectal cancer, or treatment concerning palliative resection or an urgent surgery were excluded.

The following factors were analyzed: age, gender, localization of the tumor, recurrence rate, (pTNM) stage, resected (removed) and metastatic (invaded) LN status and survival rate. Multivariate models were used to assess the adjusted effects and to investigate the interaction between survival and other factors.

An open and laparoscopic surgical approach was undertaken for 74 and 73 patients, respectively. Surgery was carried out according to oncologic principles, including high ligation of the vascular pedicle, en-bloc resection, adequate lymphadenectomy, and free resection margins. Following cutting of the ileocolic and right colic vessels, the right colon was mobilized by separating the terminal ileum and cecum of the retroperitoneal structures. The left branch of the middle colic artery was saved at some point in performing right hemicolectomy. However, the procedure used for the transverse colon cancer was preferred on the basis of the origin of the locality of the tumor. A tumor found within the ori-

gin of the middle colic artery was treated by right hemicolectomy, and a tumor at the center of the transverse colon was treated by transverse colectomy. The gastrocolic ligament was resected and the transverse colon was completely mobilized in order to complete a strain-free anastomosis. Side-to-side ileocolic anastomosis was mechanically performed intracorporally during a laparoscopic approach.

SPSS software suite, version 16.0 (SPSS Institute, Chicago, IL) was used for the analyses of the variables. Patient and tumor characteristics were described with use of approximate measures (mean+standard deviation and median+minimum-maximum) for quantitative variables. The Mann-Whitney U test was applied for evaluation. Mean overall survival time was estimated according to the characteristics of interest using the Kaplan-Meier function. Cox multiple regression analyses were used to simultaneously explore the effects of several variables on overall survival.

Results

A total of 56 (38,1%) men and 91 (61,9%) women, mean age being $61,8 \pm 15,9$ years, were included. 47 (32%) tumors were located within the ascending colon. Of the 147 patients, 118 (81,3%) had more than 12 LN resected, 70 (52,4%) had LN involvement, 41 (30,4%) specifically N1 and 29 (19,7%) N2. While mean LN number was $18,8 \pm 9,44$, the metastatic LN number was $2,66 \pm 5,13$. 97 (66%) of these patients were stage T4 and 63 (42,9%) were stage II (Table 1).

The 30-day mortality rate was 4% (six patients). Mean survival time was $46,5 \pm 43,2$ months. The recurrence rate was 21,1%. Age, metastatic LN number and postoperative stage were significant in the univariate analysis for survival (Tables 2, 3) (Figure 1).

Independent predictors of survival in the multivariate analysis according to the Cox regression model were age, postoperative stage and metastatic LN (Table 4).

Discussion

This study showed that factors, like age, metastatic LN and total stage, affected survival and mortality of the affected patients with right colon cancer. The results presented in our study also agree with the findings of the literature - there was no considerable variety among the locality of the tumors within the right colon and the effects on the survival of patients.

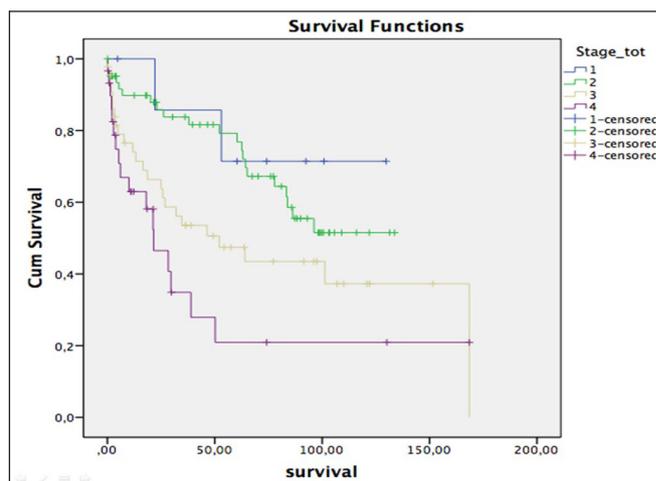
Table 1. Distribution of patients' characteristics and pathologic features.

Parameters		Numbers		
		n	%	p
Gender	Female	56	38,1	0,88
	Male	91	61,9	
Tumor localization	Ceacum	42	28,6	0,84
	Ascending colon	47	32	
	Hepatic flexure	29	19,7	
	Transverse colon	28	19	
Postoperative T stage	1	4	2,7	0,22
	2	8	5,4	
	3	38	25,9	
	4	97	66	
Postoperative N stage	0	77	52,4	0,74
	1	41	27,9	
	2	29	19,7	
Postoperative M stage	0	122	83	0,949
	1	25	17	
Total stage	I	8	5,4	0,001
	II	63	42,9	
	III	46	31,3	
	IV	30	20,4	
Recurrence	No	113	78,5	0,034
	Yes	31	21,5	

Table 2. Univariate analysis of factors affecting the survival rate.

Variables	B	HR	95.0% CI for Exp(B)		p
			Lower	Upper	
Age	,020	1,021	1,004	1,038	,017
Total stage	,211	1,235	1,098	1,390	,000
Total LN number	-,025	,975	,945	1,007	,121
Metastatic LN number	,094	1,099	1,058	1,142	,000

The prognosis of colon cancer is linked with cancer stage and histology upon diagnosis [5]. In our series, 51,7% of patients were stage III and IV and this appeared to have no effect of survival. It has been reported that LN metastasis is a prognostic feature in patients with colon cancer [6]. The location of the cancer can also be significant. However, concerning the location of the tumor in the right colon, the results here support the literature, as there were no noteworthy differences between the parts of the right colon in terms of effects on survival of the patients [7]. The relationship between high LN harvest and increased survival may be

**Figure 1.** Survival distributions according to total stage.

an indication of quality of surgical procedure for cancer resection [8]. The smallest number of nodes needed by the American Joint Committee on Cancer (AJCC) is 12, which is an indicator of surgical worthiness supported by other studies on colon cancer [9]. Additionally, the number of LN in colon cancer surgery has been identified as a potentially significant measure of the quality of cancer care by many organizations. It is generally acknowledged that tumors on the right side are related with the greatest number of resected LNs. The number of LN may be based on several variables, like the feature of the surgical resection, worthiness of pathologic assessment, tumor factors and the patient themselves [10,11]. Additionally, hospital patient volumes and number of surgeons could influence surgical value, survival and local failure rates [12]. Patients in low-volume hospitals were more prone to having fewer than seven LNs evaluated and were less likely to have positive LNs detected [13].

The median rate of LN metastases in patients included in our study was 17, higher than that found in the literature, which ranged from 7,5 to 15 [14–19]. The results of positivity in stages N and M brought about reduced survival time for patients and were comparable to a review of surveillance, epidemiology and end results by the AJCC Group, showing the poorest prognosis for patients with positive LN metastasis as would be expected. Many studies have shown that the occurrence of LN metastases is the most significant pathological determinant in survival, just as demonstrated in this study [5,9,11,20–22]. The factors that influence obtaining adequate and exact LN staging in

Table 3. Estimation of the average survival times of patients according to the characteristics of interest and the results of the comparative testing.

Variables		Mean				Median				p
		Estimate	Std. Error	95% Confidence Interval		Estimate	Std. Error	95% Confidence Interval		
				Lower Bound	Upper Bound			Lower Bound	Upper Bound	
Gender	Female	80,136	10,047	60,443	99,829	64,333	17,864	29,319	99,348	,886
	Male	92,409	8,666	75,423	109,395	83,367	16,649	50,735	115,999	
Tumor localization	Cecum	72,459	9,823	53,206	91,711	62,600	25,351	12,911	112,289	0,84
	Right colon	85,174	12,217	61,229	109,119	64,333	18,626	27,826	100,841	
	Hepatic flexure	76,729	9,833	57,457	96,002					
	Transverse colon	73,159	9,855	53,843	92,475	101,233	26,783	48,739	153,727	
Type of surgery	Appendix	63,033	0,000	63,033	63,033	63,033				0,6
	Open	86,241	9,448	67,723	104,759	64,333	17,978	29,096	99,571	
T stage	Laparoscopic	95,541	10,008	75,925	115,158	83,833	20,565	43,526	124,140	0,23
	1	39,917	17,587	5,446	74,387	21,533	14,633	0,000	50,215	
N stage	2	37,614	10,277	17,471	57,756	37,933	20,086	0,000	77,303	0,74
	3	85,389	10,085	65,622	105,156					
	4	90,858	7,968	75,241	106,474	83,367	16,721	50,593	116,140	
M Stage	0	85,496	9,217	67,431	103,560	64,333	14,912	35,107	93,560	0,95
	1	97,335	14,260	69,386	125,283					
Total stage	2	76,366	9,479	57,787	94,946	86,267				0,001
	I	103,4	16,044	71,986	134,880					
	II	93,788	6,812	80,436	107,139					
	III	80,529	12,294	56,433	104,624	52,100	20,411	12,094	92,106	
Recurrence	IV	49,526	14,725	20,665	78,387	21,533	6,316	9,155	33,912	0,03
	No	98,343	7,772	83,110	113,575	86,267	18,967	49,092	123,441	
	Yes	63,057	12,037	39,464	86,650	38,900	13,002	13,415	64,385	

Table 4. Multivariate analysis of the factors affecting the survival rate.

Variables	B	HR	95.0% CI for Exp(B)		p
			Lower	Upper	
Age	,022	1,022	1,004	1,041	,019
Total stage	,177	1,193	1,009	1,411	,039
Metastatic LN	,070	1,073	1,025	1,124	,003

patients with colon cancer are not fully understood [23]. Several studies on prognostic cancer factors revealed that the five-year survival in patients with LN metastases ranged from 0 to 11%, significantly worse than the survival ratio of 37–76% in patients without LN involvement [24]. The survival rate at five years for patients with colorectal cancer in the United States is

65% [14,15]. Survival is related to not only LN but also the T and M stage. The results presented here were satisfactory, although the series is made up by 51,7% of patients at stages III and IV with a mean survival of 46,5 months. The presence of lymph nodes affected by cancer results in higher recurrence and lower rates of survival. The recurrence rate in our study was 21,1%.

The work presented here study had various limitations. All data, without denoting the operating surgeon and the pathologist, were included. Additionally, we did not divide the patients based on right hemicolectomy with or without mesocolic excision.

Conclusion

It was demonstrated that there was dependence on various prognostic factors, like age, on overall survival

rates in right colon cancer patients. However, LN number was affected by other factors that included type of operation and the surgeon.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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