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ORIGINAL ARTICLE

Prognostic factors and patterns of recurrence after emergency management for obstructing colon cancer: multivariate analysis from a series of 2120 patients

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Abstract

Purpose At equal TNM stage, obstructing colon cancer (OCC) is associated with worse prognosis in comparison with uncomplicated cancer. Our aim was to identify prognostic factors of overall (OS) and disease-free survival (DFS) in patients treated for OCC.

Methods From 2000 to 2015, 2325 patients were treated for OCC in French surgical centers, members of the French National Surgical Association (AFC). Patients with palliative management were excluded. The main endpoints were OS and DFS. A multivariate analysis, using Cox proportional hazards regression model, was performed to determine independent prognostic factors.

Results The cohort included 2120 patients. The median of follow-up was 13.2 months. In multivariate analysis, age > 75 years, ASA score ≥ 3, ECOG score ≥ 3, right-sided colon cancer, presence of synchronous metastases, anastomotic leakage, and absence of adjuvant chemotherapy were independent OS factors. Age > 75 years, ASA score ≥ 3, right-sided colon cancer, presence of synchronous metastases, and absence of postoperative chemotherapy were independent factors of poor OS after exclusion of patients who died postoperatively. Age ≥ 75 years, ASA score ≥ 3, ECOG score ≥ 3, right-sided colon cancer, lymph node involvement, presence of vascular, lymphatic or perineural invasion, less than 12 harvested lymph nodes, and absence of adjuvant chemotherapy were independent DFS factors.

Conclusions Management of OCC should take into account prognostic factors related to the patient (age, comorbidities), tumor location, and tumor stage. Adjuvant chemotherapy administration plays an important role. For patients undergoing initial defunctionning stoma, neoadjuvant chemotherapy could be an option to improve prognosis.

Keywords Colonic obstruction · Colon cancer · Emergency surgery · Survival

The present article is based on a previous communication to the JFHOD (Journées Francophones d'Hépato-gastroentérologie et d'Oncologie Digestive) meeting on 25 March 2017 in Paris.

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Introduction

Colorectal cancer is the third most common malignancy and the fourth cause of cancer-related death worldwide [1]. Among patients with colon cancer, 8% to 16% are diagnosed with an obstruction. This rate can reach 25% in patients older than 80 years [2–5]. Acute colonic obstruction is the main complication in colon cancer and represents 85% of colonic emergencies [6]. Obstructing colon cancer (OCC) is a life-threatening emergency. It justifies adequate management of both obstruction and colonic cancer, to avoid colonic perforation and/or septic shock related to obstruction, and to limit locoregional and distant recurrence thus ensuring prolonged survival. When curative surgical treatment is achieved, several studies reported a decreased overall survival (OS) and a higher recurrence rate in patients with OCC in comparison with those with uncomplicated primary [2, 7–14]. Many confounding patient-, tumor-, and surgeon-dependent factors may explain the differences in oncological outcomes between obstructing and non-obstructing colon cancers. To date, no study has specifically assessed patterns of local and distant recurrences in patient undergoing surgery for OCC and determined prognosis factors in this population.

The aim of this national multicenter retrospective cohort study was therefore to specifically assess the prognosis of patients managed for OCC with particular focus on recurrence and factors that negatively impact oncological outcomes. For those at high risk of altered long-term outcomes, the knowledge of these specific factors could help caregivers adapting the treatment strategy and follow-up.

Material and methods

Study population

As previously described, all consecutive patients treated in emergency (within 72 h) for OCC between 1st January 2000 and the 31th December 2015 in French surgical centers, members of the French National Surgical Association (*Association Française de Chirurgie*) were retrospectively analyzed [15]. Data were retrieved from a questionnaire-based survey completed by referring surgeon of each department on a voluntary basis, after institutional approval. All collected questionnaires were registered in a database validated by the National Commission for Informatics and Liberties (*Commission Nationale de l'Informatique et des Libertés (CNIL)*). Diagnosis of colonic obstruction was established clinically and confirmed by abdominal X-ray and/or CT scan. The manuscript was prepared according to the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) statement [16].

Study endpoints

The endpoints of this study were OS, OS without postoperative deaths, and DFS. For each survival, related independent factors were identified.

Variables and outcomes measure

The following data were analyzed: demographic characteristics, tumor location, type of treatment for colonic obstruction (stent or surgery), immediate postoperative data, pathological results, and long-term oncological outcomes. Right-sided cancers included all tumors from the cecum to the transverse colon, while left-sided cancers included all tumors from the splenic flexure to the upper rectum. Primary tumor location was based on CT-scan reports, operative sheets for patients undergoing upfront surgery or on endoscopic reports for those who underwent colonic stent insertion. A tumor of the upper rectum was defined as a tumor with an inferior pole above the peritoneal reflection. Mid- and low rectal cancers were excluded from the study. Postoperative mortality and morbidity were defined as any death or complication occurring during the first 30 days, respectively, and were staged according to the Clavien-Dindo classification [17]. Tumor staging was defined according to the 6th edition of the AJCC/UICC TNM staging system for colon and rectal cancer. The survival time was calculated from the date of first admission to the date of the event of interest (death for OS, and death or first recurrence in non-metastatic patients for DFS), or the date of the last follow-up visit. In order to limit interpretation biases, we also analyzed the results of OS after exclusion of the patients who died during the first 30 postoperative days. Locoregional recurrence was defined as failure in the tumor bed, at the bowel anastomosis, or within regional lymph nodes. Distant recurrence was defined as tumor growth in any other area. All recurrences were confirmed by radiological or pathological assessment.

Patients' follow-up was usually standardized and done according to international recommendations [18]. It was performed every 3 months for the first 2 years, every 6 months for the next 3 years, and annually thereafter. During follow-up, patients underwent clinical examination, CT scan of chest and abdomen, and blood sample for CEA determination. A colonoscopy was performed 1 year after surgery and then every 3 years.

Statistical analysis

Survivals are expressed as median, with 95% confidence intervals (CIs). Survival curves were plotted according to the method of Kaplan and Meier and differences between survival distributions were assessed by the log-rank test. A cutoff of 75 years was chosen to dichotomize the age of included patients and to define elderly patients, based on the study by

Kurian and colleagues [19]. A cutoff of 25 kg/m^2 was chosen for BMI to differentiate normal weight patients and overweight/obese patients. Other continuous variables were dichotomized based on their median values. Multivariate analysis was performed using Cox proportional stepwise procedure, including every non-redundant prognostic factor identified by the univariate analysis. A p value < 0.1 was defined for systematic entry into the model. A p value < 0.05 was considered significant. Statistical analyses were performed using JMP (version 14.0.0; SAS Institute, Cary, North Carolina, USA) software.

Results

Patient characteristics

During the study period, 2325 patients with OCC were retrieved. Patients treated with palliative supportive care because of poor medical condition ($n = 10$), those with unknown date of birth ($n = 11$), tumor location ($n = 10$), and TNM stage ($n = 174$) were excluded. The characteristics of the 2120 included patients are detailed in Table 1. Seven hundred and sixty-five (36%) had proximal OCC, and the majority underwent surgery as initial management (88%). Overall 30-day postoperative mortality rate was 8.0%. Postoperative complications occurred in 1033 patients (51%) with a grade 3–4 morbidity rate of 16% (290 patients). Resection of the primary tumor was performed in 2050 patients (97%). Lymph node involvement was detected in 1178 patients (62%), and 833 patients (39%) had synchronous distant metastases. Adjuvant chemotherapy was given to 54% of patients ($n = 1088$, including 11% for stage I ($n = 2$), 34% for stage II ($n = 186$), 64% for stage III ($n = 432$), and 61% for stage IV ($n = 468$).

Overall survival

The median oncological follow-up was 13.2 months (range, 0–179). During this period, 463 patients (23%) died of the consequences of cancer (postoperative death or disease progression). The death was related to an independent cause in 202 cases (10%). Eight hundred patients (38%) were alive without disease. Three hundred and seventy-three (18%) were still alive with disease recurrence. A total of 232 patients (11%) were lost to follow-up. The median OS for the entire cohort was 64.4 months (95% CI, 55.8–70.2; range, 0–179 months) with 3-, 5-, and 10-year OS rates of 62, 51, and 41%, respectively. Prognostic factors of OS are shown in Table 2. In multivariate analysis, age ≥ 75 years, ASA score ≥ 3, ECOG score ≥ 3, right-sided colon cancer, presence of synchronous metastases, anastomotic leakage, and absence of postoperative chemotherapy were independent factors of poor OS. After exclusion of the patients who died during the first 30 postoperative days, the median OS was 77.6 months

Table 1 Descriptive characteristics of 2120 patients treated for obstructing colon cancer

Characteristics	Overall cohort (%) $n = 2120$
Sex	
Male	1122 (53)
Female	998 (47)
Age (years)[a]	73.6 (23.0–104.7)
Body mass index (kg/m^2)[a]	23.6 (12.2–55.5)
ASA score	
< 3	1211 (64)
≥ 3	688 (36)
ECOG performance status	
< 3	1475 (88)
≥ 3	195 (12)
Site of tumor	
Right-sided colon	765 (36)
Left-sided colon	1355 (64)
Initial management	
Endoscopic stent	245 (12)
Upfront surgery	1875 (88)
Anastomotic leakage	
Yes	178 (12)
No	1314 (88)
Postoperative complication	
Dindo 3–4	290 (16)
Dindo 0–2	1579 (84)
Size of tumor (cm)[a]	4.5 (0.8–31)
pT stage	
pT1–2	42 (2)
pT3	1023 (54)
pT4	845 (44)
Vascular invasion	887 (52)
Lymphatic invasion	685 (48)
Perineural invasion	759 (46)
Total lymph nodes[a]	18 (0–160)
Less than 12 lymph nodes retrieved	327 (18)
pTNM stage	
Stages 0–I	19 (1)
Stage II	574 (27)
Stage III	694 (33)
Stage IV	833 (39)
Adjuvant chemotherapy	1088 (54%)
Academic hospital	
Yes	1730 (82)
No	390 (18)

ASA, American Society of Anesthesiologists; *ECOG*, Eastern Cooperative Oncology Group

[a] Median (range)

Table 2 Predictive factors of overall survival at univariate and multivariate analyses

Characteristics	Univariate analysis		Multivariate analysis			
	5-year overall survival (%)	Log-rank (*p* value)	*n*	Odds ratio	95% CI	*p* value
Sex		0.69	820			
Male	52					
Female	49					
Age (years)		< 0.0001*				0.048*
≥ 75	42			1.36	1.00–1.86	
< 75	58			1		
Body mass index (kg/m^2)		0.29				
≥ 25	54					
< 25	50					
ASA grade		< 0.0001*				0.0047*
≥ 3	35			1.54	1.14–2.08	
< 3	57			1		
ECOG performance status		< 0.0001*				< 0.0001*
≥ 3	28			2.29	1.57–3.29	
< 3	56			1		
Tumor location		< 0.0001*				0.0015*
Right-sided colon	43			1.61	1.20–2.16	
Left-sided colon	55			1		
Initial management		0.077				0.59
Endoscopic stent	42			1.13	0.73–1.69	
Upfront surgery	52			1		
Synchronous metastasis		< 0.0001*				< 0.0001*
Yes	26			2.93	2.19–3.92	
No	64			1		
Anastomotic leakage		0.0037*				0.0004*
Yes	49			1.98	1.37–2.80	
No	55			1		
Postoperative complication		0.71				
Dindo 3–4	57					
Dindo 0–2	56					
Adjuvant chemotherapy		< 0.0001*				< 0.0001*
No	44			2.22	1.60–3.08	
Yes	58			1		
Academic hospital		0.63				
Yes	51					
No	48					

ASA, American Society of Anesthesiologists; *ECOG*, Eastern Cooperative Oncology Group

*$p < 0.05$ was considered significant

(95% CI, 66.4–110.0; range, 1–179 months) with 3-, 5-, and 10-year OS rates of 68, 56, and 45%, respectively. The prognostic factors of OS without postoperative deaths are shown in Table 3. In multivariate analysis, age ≥ 75 years, ASA score ≥ 3, right-sided colon cancer, presence of synchronous metastases, and absence of postoperative chemotherapy were independent factors of poor OS after exclusion of patients who died within 30 days of surgery.

Disease-free survival

Of the 1287 (61%) initially non-metastatic patients, 270 (22%) had recurrence during follow-up. The recurrence occurred with a median time of 14.5 months (range, 0.8–159.5). The location of recurrences has been detailed in Table 4. The most common site of recurrence was the liver ($n = 111$), followed by the peritoneum ($n = 85$). The median

Table 3 Predictive factors of overall survival without 30-day postoperative deaths, at univariate and multivariate analyses

Characteristics	Univariate analysis		Multivariate analysis			
	5-year overall survival (%)	Log-rank (*p* value)	*n*	Odds ratio	95% CI	*p* value
Sex		0.36	940			
Male	58					
Female	54					
Age (years)		< 0.0001*				0.0027*
≥ 75	49			1.53	1.16–2.00	
< 75	60			1		
Body mass index (kg/m^2)		0.040*				0.19
≥ 25	60			0.84	0.64–1.09	
< 25	53			1		
ASA grade		< 0.0001*				< 0.0001*
≥ 3	41			1.78	1.36–2.33	
< 3	60			1		
ECOG performance status		< 0.0001*				0.084
≥ 3	36			1.45	0.94–2.29	
< 3	60			1		
Tumor location		< 0.0001*				0.049*
Right-sided colon	48			1.32	1.00–1.73	
Left-sided colon	59			1		
Initial management		0.046*				0.37
Endoscopic stent	46			0.84	0.57–1.22	
Upfront surgery	57			1		
Synchronous metastasis		< 0.0001*				< 0.0001*
Yes	29			3.46	2.63–4.56	
No	69			1		
Anastomotic leakage		0.89				
Yes	60					
No	59					
Postoperative complication		0.68				
Dindo 3–4	58					
Dindo 0–2	56					
Adjuvant chemotherapy		< 0.0001*				0.0085*
No	54			1.49	1.11–2.00	
Yes	58			1		
Academic hospital		0.61				
Yes	56					
No	55					

ASA, American Society of Anesthesiologists; *ECOG*, Eastern Cooperative Oncology Group

*$p < 0.05$ was considered significant

disease-free survival (DFS) in non-metastatic patients was 40.1 months (95% CI, 33.3–54.1; range, 0–159.5 months) with 3-, 5-, and 10-year DFS rates of 52, 45, and 30%, respectively. The prognostic factors for DFS were shown in Table 5. In multivariate analysis, age ≥ 75 years, ASA score ≥ 3, right-sided colon cancer, lymph node invasion, presence of vascular emboli, lymphatic or perineural invasion, less than 12 retrieved lymph nodes on the surgical specimen, and absence of postoperative chemotherapy were independent factors of poor DFS.

Prognostic factors according to tumor location

Among all independent prognostic factors of poor OS and DFS, patients with right-sided colon cancer were significantly older in comparison with patients with left-sided colon cancer

(age ≥ 75 years, 53 vs. 42%, $p < 0.0001$), and significantly more frail (ECOG score ≥ 3, 14 vs. 10%, $p = 0.018$). They had significantly more lymph node invasion on the surgical specimen (68 vs. 58%, $p < 0.0001$) and received less postoperative chemotherapy (50 vs. 56%, $p = 0.015$). The other prognostic factors (ASA score ≥ 3, presence of synchronous metastases, anastomotic leakage, presence of vascular emboli, lymphatic or perineural invasion, and less than 12 retrieved lymph nodes) were comparable between the two groups.

Oncological outcomes according to tumor location and TNM stage

Figures 1, 2, and 3 and Table 6 detail OS, OS without postoperative deaths and DFS of patients with OCC according to tumor location (right-sided vs. left-sided colon) and TNM stage. Compared with left-sided colon cancer, patients with right-sided colon cancer had worse prognosis, except for stage 0–II tumors.

Discussion

In the present study including 2120 patients, we specifically addressed the long-term oncological outcomes and prognostic factors in patients managed for OCC. We found that patient's clinical status (age ≥ 75 years, ASA score ≥ 3), tumor characteristics (right-sided location, positive lymph node, vascular emboli, lymphatic, or perineural invasion), quality of surgery, and adjuvant chemotherapy were all prognostic factors for recurrence. Because one third of patients did not received adjuvant chemotherapy as indicated by clinical cancer guidelines based on pathological examination, efforts should be given to improve the treatment strategy in these patients. Our cohort has already been published [15]. However, this previous publication was dedicated on obstructing right-sided colon cancer and was mainly focused on surgical management and risk factors for postoperative morbidity, mortality and anastomotic leakage.

Several studies have investigated long-term outcomes of patients with OCC [2, 8, 11–14, 20, 21]. However, almost all of them compared patients treated in emergency for OCC and patients operated on electively, finding that OCC was associated with worse prognosis and higher recurrence rate. In addition, immediate postoperative mortality was often included thus overestimating the negative impact of the results. To our knowledge, the present study is the largest one that specifically focused on prognostic factors in patients with OCC. Atsushi and colleagues [20] reported a retrospective multicentre series of 234 patients. Patients with metastatic disease, those who underwent stoma creation with primary tumor resection and those with stage I disease were excluded. In multivariate analysis, poorly differentiated or mucinous tumors, pT4 tumors, and R1 resection were independent prognostic factors for cancer-specific survival. The monocenter study by Mulcahy and colleagues [21] included 98 patients with non-metastatic OCC who underwent curative surgery and survived the postoperative period. With a mean follow-up of 5.6 years, the 5-year cancer-specific survival was 35%. In multivariate analysis, presence of perforation associated with obstruction, advanced tumor stage, and mucinous tumors were independent prognostic factors for cancer-specific survival.

In our study, anastomotic leakage occurred in 12% of all patients. Although high, this rate is in accordance with those reported in recently published series. In a series of 234 patients with obstructing colon cancer, Biondo and colleagues [22] found an anastomotic leakage rate of 9.4%. Bakker and colleagues [23] reported in a national audit of about 31,000 patients an anastomotic leakage rate of 7.1% in case of non-elective surgery. More recently, the ESCP conducted a prospective multicenter international audit including 3208 patients undergoing elective or emergency right hemicolectomy or ileocaecal resection [24]. The overall rate of anastomotic leakage reported in this snapshot audit was 8.1% and was significantly higher in case of emergency surgery in univariate analysis (14.3 vs. 6.9%). The literature regarding the prognostic impact of the occurrence of anastomotic leakage after rectal cancer surgery is abundant. A meta-analysis involving 21 studies and 21,902 patients reported that the presence of

Table 4 Localization of recurrence in patients treated for non-metastatic obstructing colon cancer

Localization	Number
Locoregional recurrence[a]	111
Local recurrence	76
Regional lymph node recurrence	48
Distant recurrence[a]	238
Liver	108
Peritoneum	83
Lung	60
Ovary	12
Bone	10
Mediastinal lymph nodes	2
Retroperitoneal lymph nodes	4
Brain	3
Supraclavicular lymph node	1
Skin	1
Kidney	1
Spleen	1
Adrenal gland	1
NA	17

NA, not available

[a] Some patients had more than one recurrence site

Table 5 Predictive factors of disease-free survival at univariate and multivariate analyses in non-metastatic patients

Characteristics	Univariate analysis		Multivariate analysis			
	5-year disease-free survival (%)	Log-rank (*p* value)	*n*	Odds ratio	95% CI	*p* value
Sex		0.69	769			
Male	47					
Female	42					
Age (years)		< 0.0001*				0.035*
≥ 75	35			1.33	1.02–1.72	
< 75	53			1		
Body mass index (kg/m^2)		0.45				
≥ 25	50					
< 25	46					
ASA grade		< 0.0001*				0.0050*
≥ 3	34			1.42	1.11–1.81	
< 3	50			1		
ECOG performance status		< 0.0001*				0.37
≥ 3	27			1.17	0.82–1.64	
< 3	48			1		
Tumor location		< 0.0001*				0.0098*
Right-sided colon	37			1.35	1.08–1.70	
Left-sided colon	49			1		
Initial management		0.35				
Endoscopic stent	44					
Upfront surgery	45					
Anastomotic leakage		0.16				
Yes	44					
No	48					
Postoperative complication		0.18				
Dindo 3–4	48					
Dindo 0–2	49					
Tumor size (cm)		0.23				
≥ 4.5	46					
< 4.5	48					
pTNM stage		< 0.0001*				< 0.0001*
III	33			1.70	1.31–2.23	
0–II	59			1		
Vascular, lymphatic, or perineural invasion		< 0.0001*				0.0012*
Yes	35			1.53	1.18–1.99	
No	57			1		
Less than 12 lymph nodes retrieved		0.0032*				0.012*
Yes	36			1.46	1.09–1.92	
No	47			1		
Adjuvant chemotherapy		0.0001*				0.0007*
No	42			1.63	1.23–2.17	
Yes	48			1		
Academic hospital		0.92				
Yes	44					
No	45					

ASA, American Society of Anesthesiologists; *ECOG*, Eastern Cooperative Oncology Group; *pTNM*, pathological tumor-node-metastasis

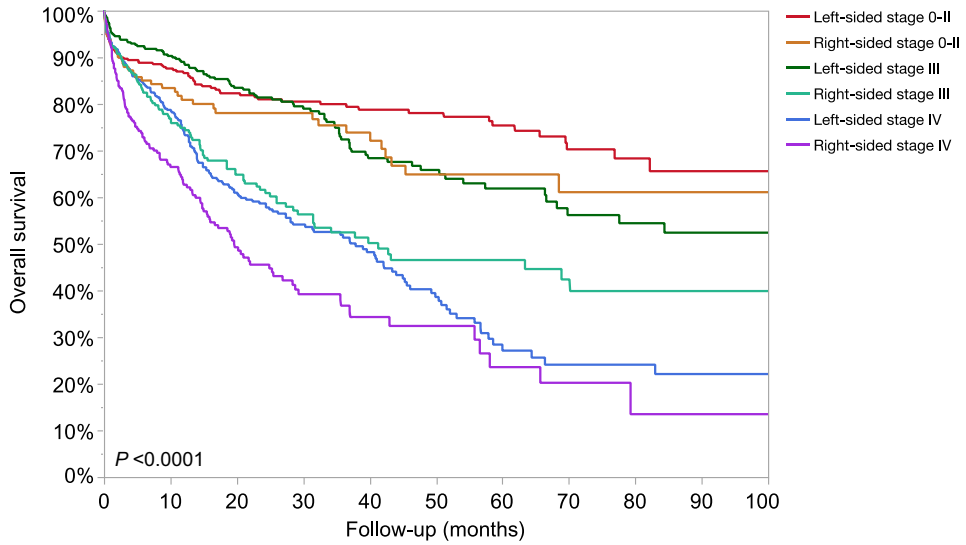
*$p < 0.05$ was considered significant

anastomotic leakage after rectal anastomosis significantly increased the risk of local recurrence [25]. However, there was heterogeneity between studies, and a recent work has suggested that the negative oncological impact of anastomotic leakage was restricted to patients with symptomatic anastomotic leakage [26]. Regarding the prognostic impact of anastomotic leakage in patients operated on for colon cancer, literature is very limited [27]. Here, we found that the occurrence of anastomotic leakage was a negative prognostic factor for OS but not for DFS. Furthermore, once we excluded the postoperative deaths, anastomotic leakage did not remain associated with an increased risk for impaired OS. These findings highlight that anastomotic leakage after surgery for OCC negatively impacts short-term mortality but does not increase the risk of recurrence.

The oncological outcomes of colonic stent insertion have been questioned several times [28]. In the present study, colonic stent did not negatively impact OS and DFS. However, our patients were unselected regarding the primary tumor location or the metastatic disease. In a recently published study

from the French Surgical Association in 518 patients with obstructing left-sided colon cancer treated with curative intent, we demonstrated that overall survival was significantly lower in the stent group compared with the primary diverting stoma group [28]. We observed that recurrence occurred more frequently after primary diverting stoma (57%) than colonic stent (47%), but this difference was not statistically significant ($p = 0.5$). After adjustment for the propensity score, there was no difference between the two groups for disease-free survival. It was our hypothesis that although not significant, stented patients were at lower risk of recurrence but were at higher risk to die from a recurrence when it occurred. The recent French and European guidelines state that colonic stent is not indicated as a curative intent but can be an option in obstructed palliative patients [28–30].

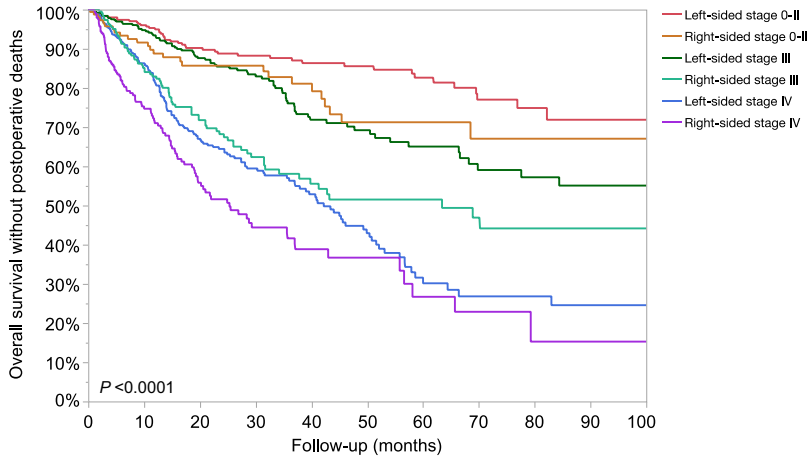
Right-sided and left-sided colon cancers differ in terms of their embryological origin, clinical presentation, histological characteristics, phenotype, genetic anomalies, and gene expression profile [31, 32]. Epidemiological studies have shown an increase in the incidence of right-sided colon cancers, and a distal-to-proximal gradient with age, with more tumors located in the proximal colon in elderly patients [33–35]. Several studies have examined the survival of patients after surgery for colon cancer, depending on tumor location [36–42]. Most of them reported worse long-term outcomes in patients with right-sided colon cancer compared with patients with left-sided colon cancer [38–44]. A recent meta-analysis including 66 studies with 1,437,846 patients found that left-sided colon cancer was associated with an increased survival rate in comparison with right-sided colon cancer (HR = 0.82; 95% CI, 0.79–0.84; $p < 0.001$) [44]. This difference in survival was observed regardless of TNM stage and administration of adjuvant chemotherapy. Here, we found that the prognostic impact of tumor location was also observed in the group of patients with OCC. This finding could raise questions about the best management strategy for patients with obstructing right-sided colon cancer. Indeed, currently, these patients undergo surgery, with a right hemicolectomy with primary anastomosis as procedure of choice, followed by adjuvant oxaliplatin-based chemotherapy for those with high-risk stage II or III disease. Another option for those patients could be double end-stoma creation (ileostomy and colostomy) with primary tumor resection. This strategy would avoid the risk of anastomotic leakage [22–24] thus decreasing the risk to postpone or even preclude adjuvant chemotherapy administration. Here, we found that the negative association between right-sided colon cancer and prognosis disappeared with early stage tumors. This finding could be explained by the fact that the number of patients in this group was too small to find a significant difference.



Number at risk:

Left-sided stage 0-II	410	200	125	77	33	19
Right-sided stage 0-II	183	77	43	25	11	8
Left-sided stage III	414	220	99	55	29	16
Right-sided stage III	280	108	43	26	13	9
Left-sided stage IV	531	167	74	22	13	9
Right-sided stage IV	302	68	23	8	3	3

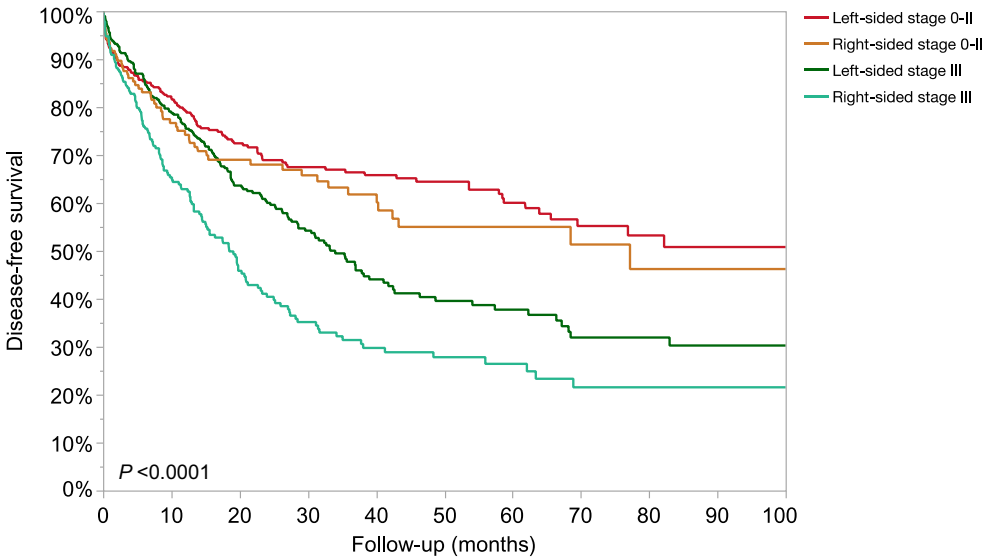
Fig. 1 Overall survival of patients with right-sided versus left-sided colon cancer according to TNM stage



Number at risk:

Left-sided stage 0-II	369	200	125	77	33	19
Right-sided stage 0-II	165	77	43	25	11	8
Left-sided stage III	391	220	99	55	29	16
Right-sided stage III	252	108	43	26	13	9
Left-sided stage IV	467	167	74	22	13	9
Right-sided stage IV	263	68	23	8	3	3

Fig. 2 Overall survival without 30-day postoperative deaths of patients with right-sided versus left-sided colon cancer according to TNM stage



Number at risk:

Left-sided stage 0-II	383	174	108	63	27	16
Right-sided stage 0-II	173	73	38	22	9	7
Left-sided stage III	386	171	68	39	21	11
Right-sided stage III	268	81	34	19	10	7

Fig. 3 Disease-free survival of patients with right-sided versus left-sided colon cancer according to TNM stage

Table 6 Oncological outcomes according to tumor location and TNM stage

	Right-sided colon cancer (%)	Left-sided colon cancer (%)	Log-rank *p* value
5-year overall survival			
All stages	43	55	< 0.0001*
Stages 0–II	65	75	0.22
Stage III	47	62	< 0.0001*
Stage IV	24	27	0.0014*
5-year overall survival without postoperative deaths			
All stages	48	59	< 0.0001*
Stages 0–II	71	83	0.11
Stage III	52	65	< 0.0001*
Stage IV	27	30	0.0032*
5-year disease-free survival			
All stages	37	49	< 0.0001*
Stages 0–II	55	60	0.35
Stage III	26	38	< 0.0001

TNM, tumor-node-metastasis

*$p < 0.05$ was considered significant

Stage II colon cancer is a very heterogeneous group of tumors, with 5-year OS rates ranging from 87.5 to 58.4% [45]. The interest of adjuvant chemotherapy in stage II colon cancers is still controversial [46] but is widely accepted in the subgroup of high-risk stage II tumors defined as pT4, perforated, poorly differentiated, presence of lymphovascular or perineural invasion, and fewer than 12 harvested lymph nodes providing no microsatellite instability is identified [47–49]. In stage II tumors, obstruction is considered as a prognostic factor for recurrence by the European Society for Medical Oncology and the National Comprehensive Cancer Network Guidelines but not by the American Society of Clinical Oncology [18, 50, 51]. In the present series, we found that postoperative chemotherapy was an independent predictor of increased survival, whether for OS or DFS. According to our results, adjuvant chemotherapy should be discussed in all patients managed for OCC. For those with stage II OCC, this may improve oncological outcomes. One should however emphasize that in French daily clinical practices, one third of patients did not received adjuvant chemotherapy as indicated by clinical cancer guidelines based on pathological examination. For patients with left-sided obstructing colon cancer, primary diverting colostomy followed by neoadjuvant systemic chemotherapy may improve the prognosis of these patients by treating micrometastatic disease, inducing tumor "downstaging" and improving the completeness and the quality of surgery during the subsequent oncological colonic resection [52, 53].

The current work suffers from several limitations. First, it is a study with a 15-year inclusion period. During this time, significant advances occurred in the management of patients, such as chemotherapy regimens. However, progress in chemotherapy protocols has been progressively applied to all patients included in this cohort. Surgical treatment strategies for OCC also changed during this period, with in particular a large number of publications on the potential interest of the colonic stent in this situation [24–26]. Secondly, the oncological follow-up should have been longer to give more weight to the survival results. Finally, it is a retrospective study, with potential selection bias, as the collected data were provided by the surgeons of each center on a voluntary basis. We believe that the significant number of included patients and the participation of academic and non-academic hospitals give a good overview of patients treated for OCC and suggest that our results are relevant.

Conclusion

Our results provide a better understanding of long-term outcomes for patients managed for OCC. This may improve decision-making regarding initial management, discussion of adjuvant chemotherapy, and postoperative surveillance.

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