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ORIGINAL ARTICLE

Right-sided vs. left-sided obstructing colonic cancer: results of a multicenter study of the French Surgical Association in 2325 patients and literature review

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Abstract

Purpose Few studies compared management and outcomes of obstructing colonic cancer (OCC), according to the tumor site. Our aim was to compare patient and tumor characteristics, postoperative and pathological results, and oncological outcomes after emergency management of right-sided vs. left-sided OCC.

Methods A national cohort study including all consecutive patients managed for OCC from 2000 to 2015 in French surgical centers members of the French National Surgical Association (AFC).

Results During the study period, 2325 patients with OCC were divided in right-sided ($n = 819$, 35%) and left-sided ($n = 1506$, 65%) locations. Patients with right-sided OCC were older, more frequently females, and associated with comorbidities, history of cancer, or previous laparotomy. Surgical management was more frequently performed for right-sided than left-sided OCC (99 vs. 96%, $p < 0.0001$). Tumor resection was more frequently performed in right-sided OCC (95 vs. 90%, $p < 0.0001$). Among the resected patients, primary anastomosis was more frequently performed in case of right-sided OCC (86 vs. 62%, $p < 0.0001$). Definitive stoma rate was lower in right-sided location (17 vs. 46%, $p < 0.0001$). There was no significant difference between locations in terms of cumulative morbidity, anastomotic leak, unplanned reoperation, and mortality. Five-year overall and disease-free survival rates were significantly lower in right-sided OCC (43 and 36%) than in left-sided OCC (53 and 46%, $p < 0.0001$ and $p = 0.001$, respectively).

Conclusions Although patients with right-sided OCC are frailer than left-sided OCC, tumor resection and anastomosis are more frequently performed, without difference in surgical results. However, right-sided OCC is associated with worse prognosis than distal location.

Keywords Colonic obstruction · Right-sided obstructing colon cancer · Left-sided obstructing colon cancer · Survival · Emergency surgery · National database

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Introduction

Being the third most common cancer worldwide, colorectal cancer (CRC) represents a major public health issue [1]. About 20% of patients with CRC are diagnosed with acute colonic obstruction, which is located in the right or left colon in one and two thirds of cases, respectively [2]. Management of patients with obstructive colonic cancer (OCC) raises two challenges: first, the need to relief in emergency bowel obstruction and its consequences such as dehydration, electrolyte imbalance, or intra-abdominal sepsis due to colonic ischemia and or perforation and secondly, the adequate treatment of the obstructed colonic cancer itself which is generally locally advanced or metastatic and occur in elderly patients with poor medical conditions or in patients with significant comorbidities [3]. As a consequence, urgent surgery for obstructive tumor is often associated with increased risk of postoperative morbidity, mortality, and permanent stoma rates [4–7].

Management of proximal OCC is more established than distal location: right colectomy with primary anastomosis is the preferred surgical option [7–9], whereas for obstructive left-sided tumors, there is no real consensus between subtotal colectomy with anastomosis, segmental colectomy with or without anastomosis, primary diverting stoma, and endoscopic stent [4, 10–14]. Five studies have compared the management and outcomes of OCC according to the location of the primary and their results are conflicting [15–19]. All but one [18] are monocentric, the studied population is small and heterogeneous including patients undergoing resection with primary anastomosis and curative resection only or patients with non-malignant obstruction. Furthermore, all have focused on the first-stage surgery with no detail on the subsequent procedures and have excluded from analysis colonic stent insertion at initial management.

The objective of the present multicentric retrospective cohort analysis was to compare patients and tumor characteristics, management, and outcomes of right- or left-sided OCC at a national level. We also aimed to perform a review of the literature on this particular subject.

Patients and methods

Study population

Data from all consecutive patients who were managed for OCC between January 2000 and December 2015 in surgical centers members of the French National Surgical Association (Association Française de Chirurgie (AFC)) were retrospectively analyzed. The collected data were provided by the surgeons of each center after institutional approval [7, 13]. Acute colonic obstruction was defined clinically and confirmed by imaging (abdominal X-ray and/or abdominal CT scan) [7, 13]. Proximal OCC was defined as an obstructive tumor proximal to or at the splenic flexure and distal obstruction was defined as an obstructive tumor distal to the splenic flexure. Patients who were treated only with palliative supportive care because of poor medical conditions were excluded from the study.

Outcome measures

Postoperative mortality and morbidity were defined as any death or complication occurring during the first 30 days, respectively, and were classified according to Clavien-Dindo classification [20]. Cumulative morbidity included complications occurring at each surgical stage for patients who underwent planned multi-stage procedures. Overall survival was defined as the period of time between the date of surgery and the date of death, whatever the cause. For non-metastatic patients, disease-free survival was defined as the period of time between the date of surgery and the date of the first relapse of the disease (locoregional or distant) or death. Patients alive with no evidence of disease at last follow-up were censored.

Statistical analysis

Quantitative data were reported as mean and standard deviation, and categorical data were reported as absolute numbers and percentages. Quantitative data were analyzed with the Student's t test. Categorical data were compared using the Pearson's χ^2 test or the Fisher's exact test, as appropriate. Survival curves were plotted according to the method of Kaplan and Meier and differences between survival distributions were assessed by the log-rank test. All tests were two-sided, with a level of significance set at $p < 0.05$. Statistical analyses were performed using Statistical Package for the Social Sciences (SPSS Inc., version 24.0, Chicago, IL) and JPM (version 12.1.0; SAS Institute, Cary, NC, USA) softwares. This study was conducted according to the ethical standards of the Committee on Human Experimentation of our institution and reported according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines [21].

Results

Patient characteristics

From 2000 to 2015, 2325 patients with OCC were retrieved. The obstruction was confirmed by imaging in 712 patients (92%). OCC was located proximal in 819 patients (35%) and distal in 1506 patients (65%). Patients with right-sided OCC were older, more frequently

females, more frequently associated with comorbidities, and with history of cancer or previous laparotomy than those with left-sided OCC (Table 1). On initial CT scan, ileocecal valve was less frequently competent in right-sided OCC (47 vs. 61%, $p < 0.0001$) and bowel parietal pneumatosis was less frequently observed in right-sided than left-sided OCC (4 vs. 8%, $p < 0.0001$). Rate of synchronous metastatic disease was similar between the two groups on initial imaging.

Management of OCC

Endoscopic stent was less frequently placed in right-sided location ($n = 34$, 4%) than left-sided location ($n = 218$, 15%, $p < 0.0001$), but no difference was observed in terms of stent-related complications (13 vs. 15%, $p = 0.8$). Surgical management was more frequently performed in right-sided ($n = 809$, 99%) than left-sided OCC ($n = 1446$, 96%, $p < 0.0001$) (Table 2). At surgical exploration, right-sided tumors were more

Table 1 Characteristics of the 2325 patients presenting with an obstructive colonic cancer (OCC)

n	Right-sided OCC 819	Left-sided OCC 1506	*p* Value
Gender			*0.008*
Male	401 (49)[a]	824 (55)	
Female	418 (51)	682 (45)	
Age (years)	74 ± 13[b]	71 ± 14	*< 0.0001*
> 70 years	535 (66)	835 (56)	*< 0.0001*
BMI (kg/m^2)	24 ± 5	24 ± 5	0.2
ASA score			0.053
1	175 (24)	276 (20)	
2	281 (38)	578 (43)	
3	231 (32)	437 (32)	
4	43 (6)	57 (4)	
NA	89	158	
ECOG Performance Status			*< 0.0001*
0	158 (25)	411 (34)	
1	220 (34)	384 (32)	
2	161 (25)	260 (22)	
3	74 (12)	118 (10)	
4	27 (4)	23 (2)	
NA	179	310	
Comorbidities			
Yes	538 (77)	915 (67)	*< 0.0001*
Vascular	395 (57)	663 (49)	*0.001*
Respiratory deficiency	131 (19)	196 (14)	*0.01*
Neurologic deficiency	124 (18)	198 (15)	0.06
Malnutrition	123 (18)	190 (14)	*0.03*
Renal deficiency	55 (8)	82 (6)	0.1
Diabetes	39 (6)	85 (6)	0.6
Hepatic deficiency	28 (4)	39 (3)	0.2
History of cancer	127 (17)	182 (13)	*0.01*
History of laparotomy	256 (34)	341 (24)	*< 0.0001*
Hemodynamic instability at admission	41 (6)	60 (5)	0.2
Synchronous metastases	235 (33)	448 (33)	0.9

Hemodynamic instability was defined as all patients who received vasopressors preoperatively or by the occurrence of one of the following signs: systolic arterial pressure < 90 mmHg, mean arterial pressure < 70 mmHg, heart rate > 120/min, urine output < 15 mL/h, and/or confusion

BMI body mass index, ASA American Society of Anesthesiologists, ECOG Eastern Cooperative Oncology Group, NA not available

[a] Number (percentage)

[b] Mean ± standard deviation

Table 2 Management of patients admitted for obstructive colon cancer, according to tumor location

Characteristics	Left-sided OCC ($n = 1506$)	Right-sided OCC ($n = 819$)
Endoscopic stent	271 (18)	34 (4)
As a bridge to surgery	218 (14)	27 (3)
Upfront surgery		
First-stage procedure		
Proximal diverting stoma	456 (30)	48 (6.2)
Hartmann's procedure	246 (16)	
SR with primary anastomosis	230 (15)	582 (75)
SR with anastomosis and diverting stoma	42 (3)	21 (2.7)
SR without anastomosis and double-end stomas	57 (4)	113 (14.5)
STC with primary anastomosis	138 (9)	
STC with anastomosis and diverting stoma	19 (1)	
STC without anastomosis and double-end stomas	32 (2)	
Palliative internal diversion	4 (0.3)	4 (0.5)
Second-stage procedure	592 (41)	104 (13)
Following proximal diverting stoma	321 (21)	23 (3)
Hartmann's reversal	78 (5)	
Stoma closure following SR or STC	123 (8)	64 (8)
Third-stage procedure	68 (5)	1 (0.1)

SR segmental resection, STC (sub)total colectomy

frequently in contact with neighboring organs (18 vs. 15%, $p = 0.04$), and associated with clinically suspected involved lymph nodes (33 vs. 18%, $p < 0.0001$) or metastases (34 vs. 29%, $p = 0.02$). Among synchronous metastases, peritoneal carcinomatosis was more frequently encountered in right-sided OCC than left-sided location without significant difference (113/257, 44% vs. 138/366, 38%, $p = 0.1$), whereas liver metastases were less frequently observed in right-sided OCC (171/257, 67% vs. 277/366, 76%, $p = 0.01$). Resection of primary tumor was more frequently performed during the first surgical stage in right-sided OCC (93%) than left-sided OCC (66%, $p < 0.0001$). Among these resected patients, primary anastomosis was more frequently performed in case of right-sided location (86 vs. 62%, $p < 0.0001$). In the presence of primary anastomosis, a defunctioning stoma was less frequently realized for right-sided than left-sided OCC (6 vs. 27%, $p < 0.0001$). No difference was observed between groups for resection of metastases (6 vs. 5%, $p = 0.3$) nor intraoperative complications (3 vs. 4%, $p = 0.4$). A second surgical stage occurred less frequently for right-sided OCC (13%) than left-sided OCC (41%, $p < 0.0001$). A third surgical stage was performed in 1 patient with right-sided OCC (0.1%) and 68 patients with left-sided OCC (5%, $p < 0.0001$) (Table 2).

Postoperative outcomes

Thirty-day postoperative outcomes after the first-stage procedures are given in Table 3. Postoperative mortality and overall morbidity were significantly higher in right-sided OCC. Patients in the right-sided OCC group had significantly *less* anastomotic leakage (13 vs. 18%, $p = 0.01$), more wound complications (11 vs. 7%) resulting to a higher rate of reintervention (12 vs. 9%, $p = 0.02$). Conversely, patients in the left-sided OCC group experienced more stoma-related complications (3 vs. 1%, $p = 0.0005$). Cumulative morbidity and mortality, including all surgical procedures, are reported in Table 3. There was no significant difference between locations in terms of overall morbidity, anastomotic leak, unplanned reoperation, and mortality. Major morbidity was less frequently observed in right-sided location than left-sided location (30 vs. 37% of overall morbidity, $p = 0.04$). The cumulative mean hospital stay was 15 days in the right-sided group and 17 days in the left-sided group ($p = 0.001$). At the end of follow-up, the cumulative rate of tumor resection was significantly higher in right-sided location (95 vs. 90%, $p < 0.0001$), and the definitive stoma rate was lower in right-sided location (17 vs. 46%, $p < 0.0001$).

Pathological results

Pathological results are reported in Table 4. Tumor perforation was reported in 10 and 12% of patients with right-sided and left-sided OCC, respectively ($p = 0.09$).

Table 3 Postoperative (30-day) outcomes after the first-stage procedure and cumulative morbidity

	Overall ($n = 2325$)	Right-sided OCC ($n = 819$)	Left-sided OCC ($n = 1506$)	*P* value*
First-stage procedure				
Any postoperative complication	1009 (43)[a]	409 (50)	600 (40)	*< 0.0001*
Number of postoperative complications				
0	1316 (57)	410 (50)	906 (60)	*< 0.0001*
1	910 (39)	364 (44)	546 (36)	0.2
2	83 (4)	41 (5)	42 (3)	
≥ 3	16 (1)	4 (0.5)	8 (0.5)	
Medical morbidity				
Urinary tract infection	104 (4)	44 (5)	60 (4)	0.1
Pulmonary complications	129 (6)	55 (7)	74 (5)	0.085
Cardiac complications	122 (5)	51 (6)	71 (5)	0.1
DVT/PE	58 (2)	22 (3)	36 (2)	0.8
Neurological complication	86 (4)	40 (5)	46 (31)	*0.03*
Surgical morbidity				
Anastomotic leakage	156/1032[b] (15)	77/603 (13)	79/429 (18)	0.01
Wound complications	204 (9)	93 (11)	111 (7)	*0.0015*
Stoma-related complications	76 (3)	12 (1)	64 (3)	*0.0005*
Hemorrhage	61 (3)	28 (3)	33 (2)	0.1
Prolonged operative ileus	64 (3)	22 (3)	42 (3)	0.99
Unplanned reoperation	224 (10)	95 (12)	129 (9)	*0.02*
Dindo classification				0.1
I-II	557 (24)	231 (28)	326 (22)	
III-IV	270 (12)	97 (12)	173 (11)	
Mortality	182 (8)	81 (10)	101 (7)	*0.008*
Length of hospital stay (days)[c]	17 ± 17	17 ± 13	17 ± 13	0.5
Cumulative surgical outcomes				
Mortality	200 (9)	82 (10)	118 (8)	0.1
Overall morbidity	952 (41)	342 (42)	610 (42)	0.99
Anastomotic leakage	197/1503 (13)	82/667 (12)	115/836 (14)	0.44
Dindo classification				*0.04*
I-II	623/952	238/342 (70)	385/610 (63)	
III-IV	329/952	104/342 (30)	225/610 (37)	
Unplanned reoperation	12 (0.5)	102 (13)	171 (12)	0.6
Length of hospital stay (days)[b]		15 ± 13	17 ± 17	*0.001*
Definitive tumor resection	2079 (89)	780 (95)	1299 (90)	*< 0.0001*
Definitive stoma	793 (34)	135 (17)	658 (46)	*< 0.0001*

DVT deep venous thrombosis, PE pulmonary embolism

*p value significant at the 0.05 level (comparison between the three groups)

[a] Number of patients (percentage)

[b] Among patients with anastomosis

[c] Mean ± standard deviation

The rate of patients with positive lymph nodes was not significantly different between groups (36 vs. 30%, $p = 0.07$) but the mean number of involved lymph nodes was higher in right-sided location (4 ± 5 vs. 2 ± 4, < 0.0001). Vascular emboli were more frequently observed in case of right-sided OCC (42 vs. 36%, $p = 0.001$), whereas perineural invasion was less frequently encountered (40 vs. 48%, $p = 0.001$). Adjuvant chemotherapy was less frequently performed after right-sided OCC than left-sided OCC (49 vs. 53%, $p = 0.048$).

Table 4 Pathological results of 2079 patients who underwent the resection of the obstructive colonic cancer (OCC)

n	Right-sided OCC 780	Left-sided OCC 1299	*p* Value
Longitudinal resection margin (cm)	10 ± 7[a]	8 ± 6	*< 0.0001*
Tumor perforation	64 (10)[b]	134 (12)	0.09
NA	111	197	
TNM classification			*< 0.0001*
Stage 0-I	12 (2)	8 (1)	
Stage II	172 (22)	405 (30)	
Stage III	280 (36)	414 (30)	
Stage IV	308 (40)	540 (40)	
NA	7	10	
Harvested lymph nodes	21 ± 11	21 ± 13	0.3
Involved lymph nodes	4 ± 5	2 ± 4	*< 0.0001*
Vascular emboli	350 (42)	544 (36)	*0.001*
NA	33	44	
Lymphatic invasion	266 (49)	433 (45)	0.1
NA	73	88	
Perineural invasion	251 (40)	528 (48)	*0.001*
NA	35	53	

NA not available, TNM tumor node metastasis stage

[a] Mean ± standard deviation

[b] Number (percentage of available data)

Oncological results

One-, 3-, and 5-year overall survival (OS) rates were significantly lower in the presence of right-sided OCC (72, 52, and 43%) than left-sided OCC (81, 65, and 53%, $p < 0.0001$) (Fig. 1a). After the patients were stratified according to tumor stage, statistical differences were found between the two groups for stage III and IV in OS. While the 1-, 3-, and 5-year OS rate for stage I and II cancers in the right-sided group was 81%, 75%, and 65% respectively, in the left-sided group it was 87%, 80%, and 75% ($p = 0.22$) (Fig. 1b). The OS rates in stage III patients in the right-sided group were 75%, 52%, and 47%, and in the left-sided group it was 89%, 72%, and 62% ($p < 0.0001$) (Fig. 1c). Finally, in stage IV cancers the OS rates in the right-sided group were 63%, 37%, and 24% and 75%, 55%, and 29% in the left-sided group ($p = 0.0006$) (Fig. 1d).

One-, 3-, and 5-year disease-free survival (DFS) rates were significantly lower in the presence of right-sided OCC (67, 43, and 36%) than left-sided OCC (75, 53, and 46%, $p = 0.0014$) (Fig. 2a). After the patients were stratified according to tumor stage, statistical differences were found between the two groups for stage III in DFS. While the 1-, 3-, and 5-year DFS rate for stage I and II cancers in the right-sided group was 74%, 62%, and 55%, respectively, in the left-sided group it was 79%, 66%, and 60% ($p = 0.35$) (Fig. 2b). The DFS rates in stage III patients in the right-sided group were 63%, 31%, and 26%, and in the left-sided group it was 76%, 48%, and 38% ($p < 0.0001$) (Fig. 2c).

Discussion

The present series is to our knowledge the largest one comparing right-sided and left-sided OCC. We reported that (1) right-sided OCC occurred more frequently in old and frail patients and were more locally advanced at surgical exploration than left-sided location; (2) resection with primary anastomosis was mainly performed in patients with right-sided OCC, whereas for those with left-sided OCC, primary diverting stoma was the preferred option; (3) while 30-day postoperative morbidity and mortality after the first stage procedure were significantly higher in patients with right-sided OCC, cumulative morbidity and pathological results were similar between the two groups; and (4) prognosis was poorer in patients with stage III and stage IV right-sided OCC compared to their left-sided counterparts. Right-sided and left-sided colon cancers are considered as two distinct entities, with differences in epidemiology, biology, pathology, and clinical outcomes [22–24]. In the setting of OCC, five series have compared the surgical and oncological outcomes between the proximal and distal location [15–19] (Table 5). In the present series, obstruction due to left colonic cancer occurred more frequently than obstruction due to right colonic cancer (65% vs. 35%), which is consistent with the literature [2, 15–19]. We reported that patients with right-sided OCC were older, more frequently females, with more comorbidities and higher ASA score than those with distal location. Our results are different from those reported in previously published series

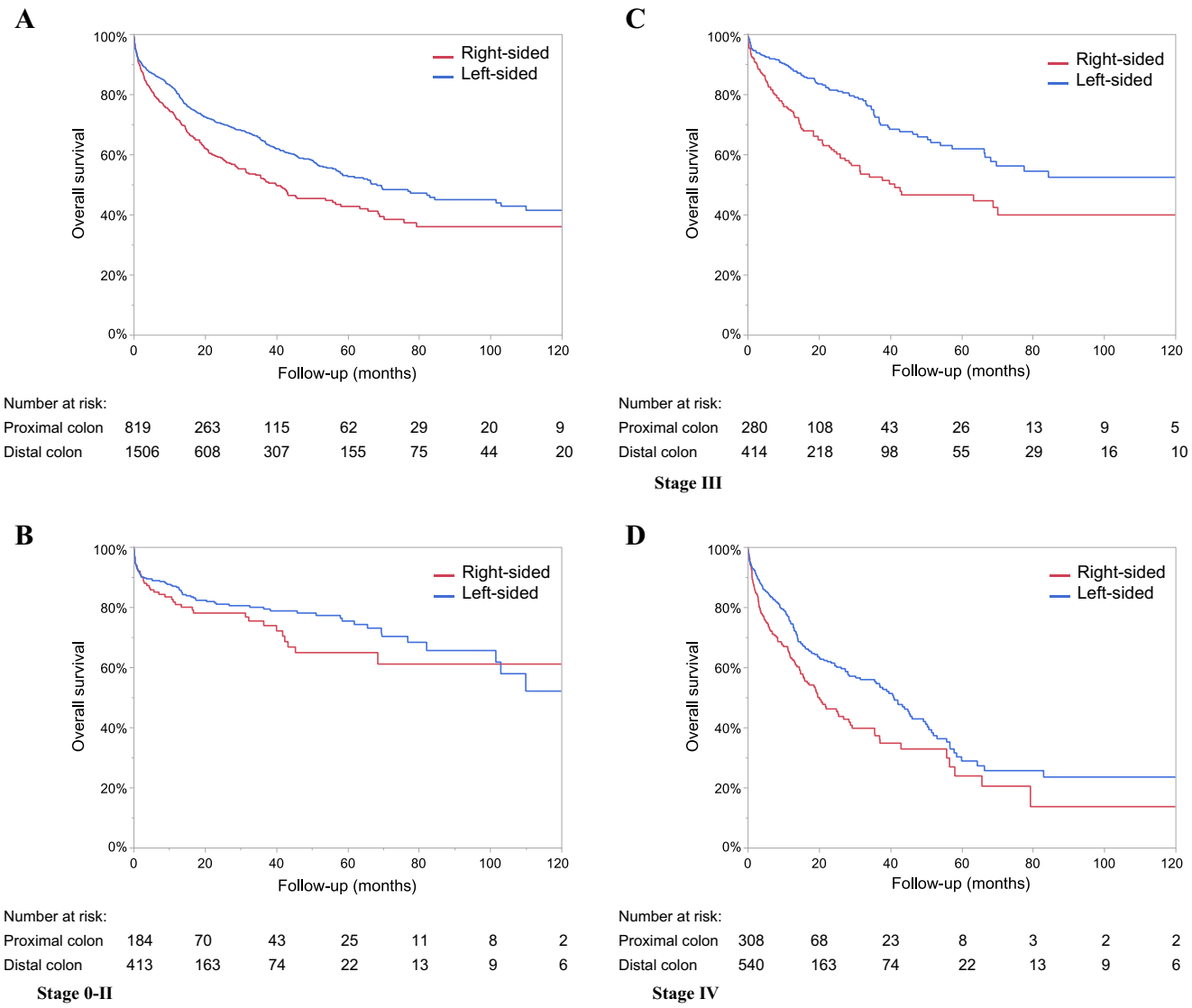

Fig. 1 Overall survival of patients operated on for right-sided (red curve) and left-sided (blue curve) OCC. **a** Entire cohort. **b** Stages I and II. **c** Stage III. **d** Stage IV

where no statistical differences were observed for age, gender, premorbid conditions, or ASA score between proximal and distal OCC (Table 5). In the series reported by Faucheron et al. [19] there were significantly more patients aged over 80 in the right-sided group. Our results are however in accordance with large series on colonic cancers where right-sided tumors are more frequently diagnosed in women, older patients, with more comorbidities than distal location [22–24]. We found that on initial CT scan, the ileocaecal valve was less frequently competent in proximal than distal OCC resulting in a decreased frequency of ischemic features such as bowel pneumatosis within the colon proximal to the obstructive tumor (4% vs. 8%, $p < 0.0001$). Similarly, Faucheron et al. [19] reported a lower rate of serosal tears and perforations of the cecum in the right group, although the difference did not reach significance.

In terms of initial management, proximal OCC was more frequently resected with primary anastomosis than distal OCC in our series and in others (Table 5). This result is not surprising as in proximal OCC, resection with primary anastomosis is the preferred surgical option [7–9], contrary to distal location where different options can be discussed [4, 10–12, 14]. In France, diverting stoma is recommended in left-sided OCC providing no bowel ischemia or perforation within the colon proximal to the obstructive tumor is present [14, 25]. Moreoever, the recent French and European guidelines state that endoscopic stent is no more indicated in curative intent but can be an option in obstructed palliative patients [26, 27]. In a recent national cohort study using a propensity score analysis, we demonstrated that, compared to primary diverting colostomy, endoscopic stent as a bridge to surgery in the curative management of patients with left-sided OCC negatively impairs prognosis [13].

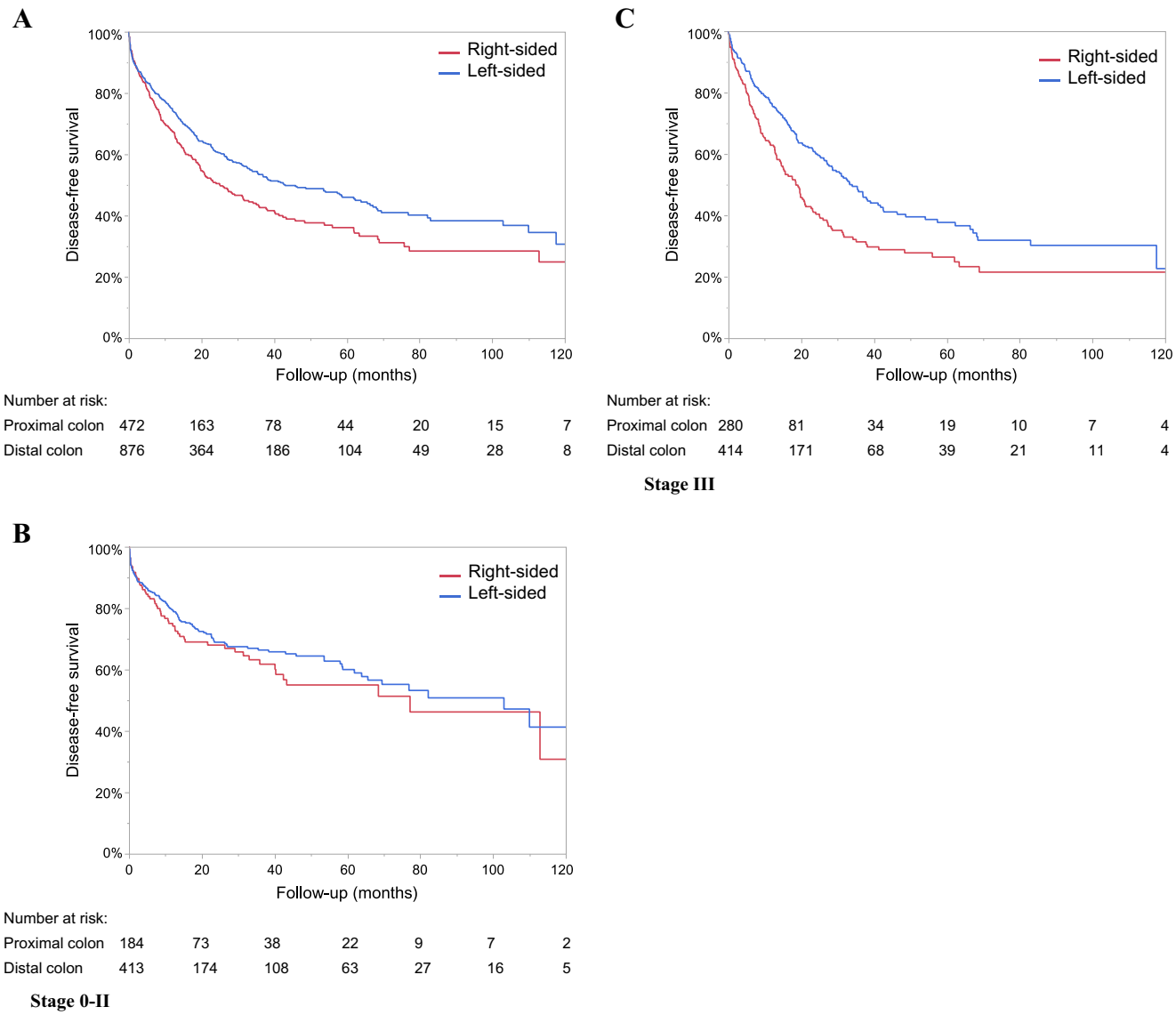

Fig. 2 Disease-free survival of patients operated on right-sided (red curve) and left-sided (blue curve) OCC. **a** Entire cohort. **b** Stages I and II. **c** Stage III

Unike other studies [15, 16, 18, 19], we found statistically significant differences in the anastomotic leakage rate between proximal and distal obstruction after the first-stage surgery, suggesting that left segmental colectomy with primary anastomosis is technically more demanding in emergency settings compared to right colectomy. In a series of 173 colectomies for proximal OCC, Frago et al. [18] showed that the leakage rate was significantly lower when surgery was performed by colorectal surgeons (5.8%) compared to general surgeons (21%, $p = 0.007$). We did not identify any predictive factors for anastomotic leakage in urgent colectomy for proximal OCC that could help surgeons to adapt the strategy in this particular setting [7].

Few data are available about pathological results between proximal and distal OCC. Uncomplicated proximal tumors are more frequently poorly differentiated, mucinous, locally advanced with positive lymph nodes and associated with peritoneal carcinomatosis than distal tumors [22–24]. In the present series, the mean number of harvested lymph nodes was similar between proximal and distal OCC. Our results are concordant with those reported by others [19]. Although the rate of stage III disease was similar between the two groups in our series, the mean number of positive lymph node was significantly higher in proximal OCC. Similarly, in the series reported by Faucheron et al. [19], a tendency toward a higher proportion of stages III and IV and significantly higher nodes positive tumors were observed in the right-sided group (77.9 vs. 51%, $p = 0.04$). In addition, in this later study, at equal stage between right- and left-sided OCC, the rate of positive lymph nodes (pN1/N2) was higher in the proximal group (74% vs. 45%, $p = $ NA). Vascular emboli were also more frequently reported in proximal OCC than in distal location in

Table 5 Literature review of series comparing proximal and distal obstructive colonic cancer

Series	Period/study	Primary tumor location	*n*	Demographic		Surgical results			Tumor stage		Oncological results
				Male: female	Age (years)	Resection + anastomosis	Anastomotic leakage	Mortality	Stage III	Stage IV	
Lee (2001) [15]	1989–1997	Proximal	107	66:41	68.7	90%	5.2%	8.1%	36.4%	23.4%	5-year OS
	Unicentric	Distal	136	85:51	68.2	74%	6.9%	9.6%	33.1%	24.1%	37.8% 34.8%
Hsu (2005) [16]	1986–2003	Proximal	80	36:44	62.5	100%	2.5%	10%	33.8%	38.0%	–
	Unicentric[b]	Distal	124	70:64	61.7	100%	2.2%	1%	33.8%	23.6%	
Tan (2010) [17]	2003–2008	Proximal	27	15:12	75	74%	Grade III-IV[a]	18.5%	44.4%	33.3%	–
	Unicentric	Distal	107	59:48	70	48%	18.5% 32.7%	10.3%	38.3%	31.8%	
Frago (2011) [18]	1994–2006	Proximal	173	110:63	–	98.8%	16.4%	14.5%	38.2%	23.7%	3-year OS
	Multicentric[c]	Distal	204	113:91	–	832.8%	7.7%*	14.7%	37.7%	27.0%	74.2% vs. 68.5% (I-II) 67.5 vs. 75.1% (III) 22.6 vs. 26.6% (IV)
Faucheron (2018) [19]	2000–2009	Proximal	31	12:19	77	87%	7.4%	-	38.7%	38.7%	2-year OS
	Unicentric	Distal	40	21:19	72	55%	4.5%	-	32.5%	27.5%	29% 47.5%
Our series	2000–2015	Proximal	819	401:418	74	Cumulative	Cumulative	Cumulative	36%	40%	5-year OS
	Multicentric	Distal	1506	824:682*	71*	93% 66%*	**12%** **14%**	10% 8%	30%	40%	43% 53%*

*Significantly different

[a] Dindo classification

[b] Patients with malignant and non-malignant obstruction were included and all underwent resection and primary anastomosis

[c] All included patients underwent curative resection

our series (42% vs. 36%, $p = 0.001$) and in the one reported by Faucheron et al. (40% vs. 20.5%, $p = NA$) [19]. Taken all together, these results suggest that, compared to distal OCC, proximal location is associated with poor histological features that may negatively impact on survival.

Several studies have referred to obstruction as a sign of poor prognosis for CRC, even after stratification by TNM stage [2, 4, 6, 28]. Right-sided colon tumors have been shown to have a higher TNM stage at presentation and to be associated with worse prognosis than left-sided locations [22, 23, 29–31]. In the particular setting of obstruction, no difference in terms of prognosis has been reported between proximal and distal colonic tumors [15, 18], even when patients were stratified according to tumor stage [18]. Recently, Faucheron et al. [19] reported higher mortality rates at 2 years for patients operated on for right-sided OCC compared to their left-sided counterparts (71% vs. 52.5%), although this difference was not significant. In our series, we observed that overall and disease-free survival were significantly lower at 1, 3, and 5 years in case of proximal OCC than distal OCC. Our results are consistent with a large body of research, which indicated potential survival benefits among patients with left-sided cancer [22, 24, 32], although several studies could not confirm this result [33, 34]. One should emphasize that, in our series, one third of patients did not received adjuvant chemotherapy as indicated by clinical cancer guidelines based on pathological examination. It is our hypothesis that, in patients with right-sided OCC, the creation of a double end-stoma (ileostomy and colostomy) with primary tumor resection could be a valid option instead of resection with primary anastomosis. This strategy would avoid the risk of anastomotic leakage and may decrease the risk of postponing or even precluding adjuvant chemotherapy administration if needed. For patients with left-sided OCC, 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 [35, 36].

It is to our knowledge that the present series suffers from several limitations inherent to its retrospective design. However, the high number of included patients as the number of participating centers ($n = 58$) brought a picture of daily practices at a national level and highlighted the various surgical issues surrounding acute malignant colorectal obstruction.

Conclusion

This largest comparative study suggests that even if patients with proximal obstructive colonic cancer are frailer than distal obstructive colonic cancer, tumor resection and anastomosis are more frequently performed, without significant difference in surgical results. However, proximal obstructive colonic cancer is associated with worse prognosis than distal obstructive colonic cancer.

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Compliance with ethical standards

Conflicts of interest The authors declare that they have no conflict of interest.

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