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Postoperative complications in individuals aged 70 and over undergoing elective surgery for colorectal cancer

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Conflict of interest

None

Abstract

Aim:

This study aims to describe the nature, incidence, severity and outcomes of in-hospital postoperative complications (POCs) in older patients undergoing elective surgery for colorectal cancer (CRC).

Method:

Patients were identified from a prospectively collected database (2009-2015) focusing on the implementation of geriatric screening and assessment in patients with cancer. Medical and surgical POCs were retrieved retrospectively from the medical records, and the severity of the POCs was graded by the Clavien-Dindo (CD) grading system. The following outcomes were analyzed comparing patients with and without CD $\geq$ 2 and CD $\geq$ 3 POCs: length of stay (LOS), transfer to the intensive care unit (ICU), 30-day readmission rates, 30-day and 1-year mortality.

Results:

One hundred and ninety patients ($\geq$ 70 years old) were included. Medical POCs (40.5%) were more frequent than surgical POCs (17.9%); 37.9% experienced CD $\geq$ 2 POCs. The most common medical POCs were: infections (26.8%), transient confusion or altered mental function (12.1%), cardiac arrhythmia (4.7%), ileus/gastroparesis/prolonged recovery of transit (4.7%). The most common surgical POCs were surgical site infections (12.1%), wound dehiscence/bleeding (4.7%), anastomotic leak (3.7%) and surgical site bleeding (3.7%). The reoperation rate was 7.9%. CD $\geq$ 2 POCs led to 11 ICU admissions and increased median postoperative LOS by 114% ($P<0.0001$ for both), but did not significantly alter 30-day readmission, 30-day and 1-year mortality rates. CD $\geq$ 3 POCs increased LOS by 162%, ($p<0.0001$) and showed an increased 1-year mortality ($p=0.07$).

Conclusion:

This study shows that in-hospital medical and surgical complications after surgery for CRC in patients $\geq$ 70y old are frequent and that complications lead to less favorable outcomes.

What does this paper add to the literature?

This paper analyzes postoperative complications in elderly colorectal cancer patients ($\geq$ 70y) in detail and compares the findings to the scarce literature in this age group. The overview can be used to inform elderly patients preoperatively about postoperative risks and to develop appropriate care plans for them in the surgical ward.

Introduction

Colorectal cancer (CRC) is the third leading cause of cancer worldwide.¹ Almost 60 % of new cases are diagnosed in patients aged 65 and over.² In non-metastatic cancer, surgery is the cornerstone of cure. In more advanced stages, surgery can be indicated to gain relief of symptoms such as bleeding, obstruction and perforation.³⁻⁶ As a consequence, higher age or the presence of comorbidity do not significantly affect the resection rate.^{5, 7-8}

Despite the benefits of surgery, the rate of adverse postoperative outcomes increases with advancing age.^{3, 7, 9} Older patients undergoing surgery have higher morbidity and mortality rates, longer lengths of hospital stay (LOS), higher readmission rates, and are more frequently not able to return home after discharge.⁷ In the older population, postoperative complications (POCs) are predominantly medical, rather than surgical.^{7, 10} Mortality is high in emergency surgery, but elective surgery is relatively safe in the elderly.^{3, 11-13} Moreover mortality rates have substantially declined over recent decades.^{7, 9, 14}

Even though life expectancy is increasing and the numbers of vulnerable older patients presenting for surgery is increasing, the elderly are often underrepresented in clinical trials, although in recent years there is more focus on older patients in surgical clinical trials.^{7, 11, 15-17} The aim of this study was to describe the nature, incidence, severity and outcomes of in-hospital postoperative complications (POCs) in individuals aged 70 and older operated on for colorectal cancer (CRC). Reported outcomes are length of stay (LOS), the number of transfers to the intensive care unit (ICU), 30-day and 1-year mortality and 30-day readmission rates.

Method

STUDY DESIGN AND POPULATION

The study population was derived from three , prospective, multicenter, non-interventional studies, performed between October 2009 and February 2015, evaluating the implementation of systematic geriatric screening and geriatric assessment (GA) in older patients with cancer.¹⁸⁻²¹ Patients aged 70 years and older with newly diagnosed cancer were included in the original studies when they presented for a cancer treatment decision. The original studies observed the relevance of the GA and the influence of the GA on treatment decisions, analyzed the given recommendations in order to standardize them, and observed the adherence to the geriatric recommendations. For this study, patients with CRC were selected if they scheduled for elective surgery in the University Hospitals of Leuven, Belgium after geriatric screening . Patients planned for neo-adjuvant therapy before surgery were excluded. The original study protocol was approved by the Ethics Committee of the hospital (S51814, S51815, S54598). Informed consent was given by the patient or the patients appropriate surrogate decision maker.

DATA COLLECTION AND OUTCOMES

Data from the original database and additional data from the patients' medical records were collected retrospectively by 2 researchers (JC and KF).

Data recorded from the original database were the patients' age, gender, frailty status (measured by the G8 screening tool²²), tumor stage and tumor location, the Charlson Comorbidity index (CCI)²³⁻²⁴, polypharmacy (defined as 5 or more medications per day) and the Eastern Cooperative Oncology Group Performance Status (ECOG-PS).²⁵

In the absence of a prospective registration system for postoperative complications in our hospital, the American Society of Anaesthesiologists (ASA) physical status score²⁶, the surgery performed, the surgical approach and the postoperative complications were retrospectively collected from the medical records. Complications that occurred during or after surgery (between the operation date and the discharge date and not present prior to surgery) were recorded. Besides screening the

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discharge letters, the full patients' medical records and notes were reviewed to confirm the diagnoses or to uncover diagnoses that were not mentioned in the discharge letters. POCs were clearly pre-defined, based on literature and clinical experience. These definitions were further adapted by consensus (KF, JC) to what could be reliably derived retrospectively from the electronic medical records.²⁷⁻³¹ The definitions used are reported in Appendix A.

The following outcomes were retrieved from the medical records: the postoperative LOS (the number of postoperative days spent in the hospital until discharge or until transfer to a rehabilitation unit), the number of transfers to the ICU during hospital stay (due to postoperative complications) and the number of unplanned readmissions within 30 days of discharge. We also recorded the in-hospital mortality, the surgical mortality (within the first 30 postoperative days) and the 1-year mortality (within 1 year after the operation). If not mentioned in the medical records, mortality data were obtained from the national mortality registry.

Besides listing the complications and reporting the major categories, the postoperative adverse events were also classified into severity grades, using the Clavien-Dindo 2004 classification system.³²

STATISTICAL ANALYSIS

Statistical analyses were performed with SAS version 9.3. Continuous data are reported using the median and the extremes. Categorical data are reported using percentage and 95% confidence intervals. Comparisons of continuous data were performed with non-parametric Wilcoxon tests. Comparisons of categorical data were performed with a Chi-Square test or with a Fisher's exact test.

Results

PATIENT AND CLINICAL CHARACTERISTICS

Figure 1 displays the patient selection and table 1 summarizes the patient and clinical characteristics. One hundred and ninety patients (105 men and 85 women) planned for elective CRC surgery, with a median age of 77 years (range 70-97), were included. One hundred and sixty-three patients (85.8%) had colon cancer and 27 patients (14.2%) had rectal cancer. Metastatic disease was present in 14.7%. One hundred and fifteen patients (60.5%) screened positive for frailty with the G8 screening tool. Most of the patients (97.9%) were classified as ASA II or III and more than half (55.8%) had comorbidities preoperatively. Polypharmacy was present in 47.4% of the patients. The majority of the patients had a good ECOG performance status (86.9% scored 0 or 1). Half of the patients (50.5%) had a laparoscopic operation. The three most common operations were right hemicolectomy (41.6%), high anterior resection (26.8%) and total mesorectal excision (8.9%).

POSTOPERATIVE COMPLICATIONS

Medical POCs occurred in 40.5% of the patients and 17.9% had surgical POCs. Eight patients (4.2%) had surgical POCs only, 51 (26.8%) had medical POCs only and 26 (13.7%) had medical and surgical POCs. Forty-two patients (22.1%) had ≥ 2 complications. The complications are displayed in table 2.

Medical complications

Infectious complications were the most common medical POCs and occurred in 26.8% of the patients. The nature of the infections is shown in table 2. The most common infection was urinary tract infection, followed by lower respiratory tract infections and catheter sepsis. Other medical

complications in descending order and grouped by organ system were: neurological (12.6%), cardiovascular (5.8%), non-infectious abdominal (5.3%), non-infectious urinary (3.7%), non-infectious respiratory (2.6%) and thromboembolic (1.6%) complications. None of the patients suffered from (other than surgical) bleeding. Details of medical POCs are illustrated in Table 2.

Surgical complications

The most common surgical POCs were surgical site infections (SSI), occurring in 12.1% of the study population. Anastomotic leak occurred in 3.7% of patients. Surgical site bleeding complicated the postoperative course in 3.7% of the patients. Seventeen patients (7.9%) required reoperation before discharge. Other surgical POCs and their rates are shown in table 2.

Severity of postoperative complications

In table 3 the recorded POCs are stratified by severity using the Clavien-Dindo Classification system. Seventy-two patients (37.9%) experienced Clavien-Dindo grade 2 and above ($CD \geq 2$) POCs. Twenty patients (10.5%) experienced Clavien-Dindo grade 3 and above ($CD \geq 3$) POCs, and 2 (1.1%) patients died during hospitalization.

OUTCOMES

The median postoperative LOS was 8 days (range 3-96). Eleven patients (5.8%) needed transfer to ICU during their hospital stay. Unplanned readmission within 30 days of discharge occurred in 16 patients (8.4%). Three patients (1.6%) died within the first 30 postoperative days, of whom 2 died in-hospital (1.1%). The 1-year mortality rate was 12.1% ($n = 23$).

The outcomes of patients with $CD \geq 2$ POCs, compared to patients with $CD < 2$ POCs, are described in table 4. $CD \geq 2$ POCs led to 11 ICU admissions (15.3% of the patients with $CD \geq 2$ POCs) and increased the median postoperative LOS from 7 to 15 days, plus 114% ($p < 0.0001$ for both), but did not significantly alter 30-day readmission rates and 30-day and 1-year mortality rates. Two patients (one operated on laparoscopically and one that underwent open surgery) died of POCs in the hospital, both in the ICU, and 1 patient, that underwent open surgery and did not experience in-hospital complications, died within 30 days of discharge.

The outcomes of patients with $CD \geq 3$ POCs (complications requiring surgical, endoscopic or radiological intervention or ICU transfer), compared to patients with $CD < 3$ POCs, are described in table 5. $CD \geq 3$ POCs increased the median postoperative LOS by 162%, from 8 to 21 days ($p < 0.0001$), and were associated with increased 1-year mortality ($p = 0.07$), but did not significantly alter 30-day readmission and 30-day mortality rates.

Discussion

This study describes POCs and outcomes in patients aged 70 and older undergoing CRC surgery. POCs were frequent and more often medical than surgical. The 3 most common medical POCs in descending order were urinary tract infections, postoperative confusion or altered mental function and respiratory tract infections. Surgical site infections were the most common surgical POCs. POCs graded ≥ 2 (by the Clavien-Dindo severity grading system) led to ICU-transfers and longer hospital stays but did not significantly alter unplanned 30-day readmissions and 30-day and 1-year mortality rates. The results were comparable for $CD \geq 3$ POCs, but the latter did show increased 1-year mortality.

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Defining the POCs was challenging. The literature describing postoperative outcomes in older patients after surgery for CRC is scarce. Moreover, reporting of outcomes often focusses on mortality and on surgical complications or classification of complications into organ systems or severity scores. Medical complications are less often reported in detail. A validated method to record postoperative complications prospectively is the Postoperative Morbidity Survey (POMS).³³ Davies et al. proved its validity in major abdominal surgery.²⁸ For the retrospective reporting of complications there is no standard method, although Patel et al. showed non-inferiority of retrospective compared to prospective data collection using the POMS in a recent study, including 85 patients undergoing major elective surgery.³⁴ This method however does not differentiate between medical and surgical complications and classifies the complications into 9 domains (pulmonary, infectious, renal, gastrointestinal, cardiovascular, neurological, wound complications, hematological, pain) without further differentiation. Because the aim of this study is to give a detailed overview of the nature of the complications in our study population, we adapted definitions from the literature to the complications encountered and to what could be reliably derived in a retrospective way from the electronic medical records in our center.

Comparison of our results to the results of studies in similar age groups is difficult because, apart from differences in patient selection, many studies do not specify the definitions used^{15, 35-37}, do not use exactly the same definitions or derive the data from ICD-9 coding.^{7, 38} In all of the studies, as in ours, infectious complications are more common than others. Compared to recent studies in similar age groups we found higher rates of urinary tract infection and relatively high rates of pneumonia.^{7, 15, 35-38} Overall both infectious complications are prevalent in the immediate postoperative period after CRC surgery. The rate of cardiac complications was similar to other studies: arrhythmia around 4 %, heart failure around 2.5 to 3% and myocardial ischemia around 0.5 to 2.5%.^{15, 36-37} In our series, apart from catheter thrombosis, we did not find any other thromboembolic complications, such as deep venous leg thrombosis, pulmonary embolism or stroke. In other series the rates of those complications are low ranging from 0.2 to 2.5%.^{15, 35-37, 39} The above mentioned complication rates are in line with a review reporting postoperative complications by age-group.³ Because postoperative delirium was not assessed in a standardized way on the surgical ward, e.g. using a Confusion Assessment Method (CAM)⁴⁰ or Delirium Observation Screening (DOS)⁴¹ scale, we only recorded transient postoperative confusion or transient depression of cerebral function when reported in the electronic medical record. This makes it difficult to differentiate between delirium, dementia, depression or other reasons for agitation or sedation and does not reflect the real incidence of postoperative delirium in our population. Prospective measurement with validated scales in elective elderly surgical CRC patients reveals incidence rates of postoperative delirium of 11-31%.⁴²⁻⁴⁵ Comparable articles report variable rates of surgical site infections in older age groups, although the mean incidence is similar to our findings.^{15, 35-37} The incidence of anastomotic leakage is comparable to other studies^{3, 15, 35-36}, except two studies that report higher rates.^{7, 37} Despite the older study population, the substantial level of comorbidity, and the burden of postoperative complications, the 30-day mortality was very low in our study (1,6 %). A review by Mamidanna et al. examining the postoperative mortality risk in patients over 70 undergoing elective colorectal resection reports mortality rates from 0 to 13.3%, and the majority of the included studies reported higher mortality rates than our study.¹² Mortality at one year is comparable to other studies.^{8, 14, 46-47} In our study mortality rates were not significantly affected by the occurrence of CD $\geq$ 2 POCs, CD $\geq$ 3 POCs were associated with an increased 1-year mortality.

This study has several strengths and learning points. The definitions used for POCs were clearly defined. The study provides information to clinicians regarding the in-hospital postoperative course in older patients with CRC, and can be used to inform patients preoperatively about postoperative risks and to develop appropriate care plans in the surgical ward.⁷ The measurement and reporting of outcomes can lead to measures to improve the safety and quality of care and allows comparison between health care providers.^{50, 52, 55-56} The study compares outcomes of patients with and without

complications: POCs graded ≥ 2 by the Clavien-Dindo grading system led to higher postoperative LOS (plus 8 days median stay for $CD \geq 2$ POCs and plus 13 days for $CD \geq 3$ POCs), and transfer to the ICU (15.3% of the patients with $CD \geq 2$ POCs), which has a considerable impact on health care costs as shown by various authors.⁴⁸⁻⁵¹ Efforts should be made to optimize recognition and management of surgical as well as medical POCs.^{47, 52} Surgeons should have medical expertise concerning the most common medical POCs and for vulnerable, multimorbid older patients collaboration with paramedics and other medical specialties is mandatory.^{5, 10, 16, 53-54}

The main limitations of our study were fivefold. First, the retrospective study design, with inclusion of a sub-cohort of patients from another study, and limitation to a single center. Second, the inclusion of a heterogeneous population regarding tumor stage, tumor location, surgical approach, type of surgery and frailty status. Third, the lack of a prospective registration system for postoperative complications in our hospital and in our country. Fourth, the absence of internationally standardized definitions to retrieve postoperative complications in detail from the medical records in a retrospective way. Fifth, we did not look at interventions to improve postoperative outcomes.

Future research needs to focus on interventions to reduce the postoperative complication rates in older surgical patients. For example, new risk stratification strategies for older patients undergoing CRC surgery based on geriatric assessment or frailty screening, pre-habilitation strategies, the application of ERAS principles, but also the effect of applying geriatric interventions based on geriatric assessment results and the effect of multimodal approaches, for instance geriatric-surgical co-management programs.

Conclusion

Elderly CRC patients pose a challenge in the postoperative period because of high medical and surgical complication rates, leading to higher of ICU use and longer hospital stays. In-hospital mortality is relatively low and post-discharge readmission and mortality were not significantly affected by the occurrence of $CD \geq 2$ POCs in our study, while $CD \geq 3$ POCs did show an association with increased 1-year mortality.

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Table 1: Patient and clinical characteristics (n=190)

		n	%	95%CI
Age	Median (range): 77 (70-97) years			
Gender	Female	85	44.7	37.7-51.8
	Male	105	55.3	48.2-62.3
G8 score¹	> 14 (screening for frailty negative)	75	39.5	32.5-46.4
	≤ 14 (screening for frailty positive)	115	60.5	53.6-67.5
Tumor stage (AJCC)	I	42	22.1	16.2-28.0
	II	60	31.6	25.0-38.2
	III	60	31.6	25.0-38.2
	IV	28	14.7	9.7-19.8
Tumor location	Colon	163	85.8	80.8-90.8
	Rectum	27	14.2	9.3-19.2
Surgical approach	Laparoscopic	96	50.5	43.4-57.6
	Open	75	39.5	32.5-46.4
	Converted (laparoscopic to open)	19	10.0	5.7-14.3
Surgery performed	RHC	79	41.6	34.6-48.6
	LHC	9	4.7	1.7-7.8
	AR	51	26.8	20.5-33.1
	IRA	2	1.1	0.0-2.5
	APER	11	5.8	2.5-9.1
	HP	10	5.3	2.1-8.4
	TME	17	8.9	4.9-13.0
	PP	6	3.2	0.7-5.6
	Combination: RHC + AR	4	2.1	0.1-4.1
	Combination: LHC + APER	1	0.5	0-1.6
ASA score	I	3	1.6	0-3.4
	II	93	48.9	41.8-56.1
	III	93	48.9	41.8-56.1
	IV	1	0.5	0-1.6
	V	0	0	0-0
Comorbidity (CCI)	0	84	44.2	37.2-51.3
	≥ 1	106	55.8	48.7-62.9
Polypharmacy	No (< 5 medications)	100	52.6	45.5-59.7
	Yes (≥ 5 medications)	90	47.4	40.3-54.5
ECOG-PS	0 (asymptomatic)	83	43.7	36.6-50.7
	1 (symptomatic but completely ambulatory)	82	43.2	36.1-50.2
	2 (symptomatic, <50% in bed during the day)	16	8.4	4.5-12.4
	3 (symptomatic, >50% in bed)	9	4.7	1.7-7.8
	4 (bedbound)	0	0	0-0

LEGEND: American Joint Committee on Cancer (AJCC) staging system; RHC: right hemicolectomy; LHC: left hemicolectomy; AR: high anterior resection; IRA: total colectomy with ileorectal anastomosis; APER: abdominoperineal excision of the rectum; HP: Hartmann procedure; TME: total mesorectal excision; PP: palliative procedure (stoma or segmental colectomy); ASA: American Society of Anesthesiologists; CCI: Charlson comorbidity index (0-37); ECOG-PS: Eastern Cooperative Oncology Group Performance Status; ¹G8: screening tool for frailty.

Table 2: Incidence of in-hospital postoperative complications (n=190)

	n	%	95%CI
MEDICAL complications	77	40.5	33.5-47.5
Infection	51	26.8	20.5-33.1
- Lower respiratory tract infection	14	7.4	
- Urinary tract infection	32	16.8	
- Cholecystitis/cholangitis	3	1.6	
- Catheter sepsis	11	5.8	
- Septic shock	1	0.5	
- Other	5	2.6	
Respiratory (non-infectious)	5	2.6	0.4-4.9
- Prolonged respiratory symptoms without the need of antibiotics or diuretics, including non-infectious COPD exacerbations	5	2.6	
Cardiovascular	11	5.8	2.5-9.1
- Cardiac arrhythmia	9	4.7	
- Cardiac arrest	2	1.1	
- Acute myocardial ischemia	1	0.5	
- Heart failure	6	3.2	
Thromboembolic	3	1.6	0-3.4
- Catheter thrombosis	3	1.6	
- Deep venous leg thrombosis	0	0	
- Pulmonary embolism	0	0	
Neurological	24	12.6	7.9-17.4
- Stroke (CVA/TIA)	0	0	
- Transient confusion or altered mental function	23	12.1	
- Epileptic insult	1	0.5	
Abdominal (non-infectious)	10	5.3	2.1-8.4
- Ileus or gastroparesis or prolonged recovery of transit	9	4.7	
- Ischemic colitis	1	0.5	
Urinary (non-infectious)	7	3.7	1.0-6.4
- Urinary retention	6	3.2	
- Renal Failure (requiring dialysis)	1	0.5	
Bleeding (other than surgical)	0	0	
Other ¹	8	4.2	1.4-7.1
SURGICAL complications	34	17.9	12.4-23.3
Anastomotic leak	7	3.7	1.0-6.4
Anastomotic ulcer and/or anastomotic bleeding	3	1.6	0-3.4
Surgical site infection (SSI)	23	12.1	7.5-16.7
- Superficial incisional SSI	5	2.4	
- Deep incisional SSI	3	1.6	
- Organ/organ space SSI	15	7.9	
Surgical site bleeding	7	3.7	1.0-6.4
Wound dehiscence and/or bleeding	9	4.7	1.7-7.8
Reoperation	15	7.9	4.1-11.7
Stoma complication (stoma necrosis) (n=24) ²	1	4.2	0-1.6

LEGEND: COPD: chronic obstructive pulmonary disease; CVA: cerebrovascular accident; TIA: transient ischemic attack; SSI: surgical site infection; ¹other non-surgical complications were: decubitus, SIADH, hiccups, swallowing disorder, acute ischemic lower limb, prolonged recovery (reason not clear), altered liver function tests; ²(percentage calculated on) the number of patients that received a stoma.

Table 3: Severity of in-hospital postoperative complications (Clavien-Dindo classification) (n=190)

		n	%	95%CI
Grade 0	No complication			
Grade I	Any deviation from the normal postoperative course without the need for pharmacological treatment of surgical, endoscopic and radiological interventions. Acceptable therapeutic regimens are: drugs as antiemetic's, antipyretics, analgesics, diuretics, electrolytes and physiotherapy. This grade also includes wound infections opened at bedside.	118	62.1	55.2-69.0
Grade II	Requiring pharmacological treatment with drugs other than such allowed for grade I complications.	52	27.4	21.0-33.7
Grade III¹	Requiring surgical, endoscopic or radiological intervention.	9	4.7	1.7-7.8
Grade IV¹	Life threatening complication requiring IC/ICU management including CNS complications ² .	9	4.7	1.7-7.8
Grade V	Death	2	1.1	0-2.5

LEGEND: IC: intermediate care; ICU: intensive care unit

¹these grades can be subdivided in a and b, which was not applied in this study

²brain haemorrhage, ischemic stroke, sub-arachnoid bleeding, but excluding transient ischemic attacks

Table 4: Outcomes for patients without (n=118) and with (n=72) Clavien-Dindo ≥ 2 in-hospital postoperative complications.

	Without complications n=118		With complications n=72				p-value ¹
Postoperative LOS median (range)	7 (3-22) days		15 (5-96) days				<0.0001
	n	%	n	%	OR	95% CI	p-value ²
Transfer to ICU	0	0	11	15.3	0.02	0.001 – 0.39	<0.0001
Unplanned readmission (within 30 days of discharge)	9	7.6	7	9.7	0.766	0.27- 2.16	0.60
- Due to surgical ³ complications	1	0.8	3	4.2	0.20	0.02-1.93	0.48
- Due to combination of surgical ³ and medical complications	2	1.7	1	1.4	1.22	0.11-13.7	
- Due to medical complications	6	5.1	3	4.2	1.23	0.30-5.09	
30-day (postoperative) mortality	1	0.8	2	2.7	0.30	0.03-3.36	0.56
1-year (postoperative) mortality	12	10.1	11	15.3	0.628	0.23-1.51	0.36

LEGEND: ¹Wilcoxon's test; ²Fisher's exact test; ³related to the primary surgery

Table 5: Outcomes for patients without (n=170) and with (n=20) Clavien-Dindo ≥ 3 in-hospital postoperative complications.

	Without complications n=170		With complications n=20				p-value ¹
Postoperative LOS median (range)	8 (3-77) days		21 (5-96) days				0.0012
	n	%	n	%	OR	95% CI	p-value ²
Transfer to ICU	0	0	11	5.0	0.002	0.0001-0.04	< 0.0001
Unplanned readmission (within 30 days of discharge)	13	7.7	3	15.0	0.4692	0.12-1.81	0.38
- Due to surgical ³ complications	3	1.8	1	5.0	0.341	0.03-3.45	0.28
- Due to combination of surgical ³ and medical complications	3	1.8	0	0	0.857	0.04-17.18	
- Due to medical complications	7	4.1	2	10.0	0.387	0.08-2.00	
30-day (postoperative) mortality	1	0.6	2	10.0	0.053	0.01-0.62	0.30
1-year (postoperative) mortality	18	10.6	5	25.0	0.355	0.12-1.09	0.07

LEGEND: ¹Wilcoxon's test; ²Fisher's exact test ³related to the primary surgery

Figure 1: Flow-chart of patient selection.

LEGEND: CRC: colorectal cancer; UH: university hospitals