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## Original research

## Total colectomy for cancer: Analysis of factors linked to patients' age



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## ABSTRACT

Total colectomy (TC) is a valid option for cancer treatment in selected cases. Emergency presentation, association to familial adenomatous polyposis (FAP) or intestinal bowel disease (IBD), hereditary non-polyposis cancer (HNPCC), and synchronous tumors are the common indications to TC for cancer. Despite potential high morbidity and mortality rates for worse general health conditions of the advanced age it has even suggested for elderly patients.

We reviewed our experience to analyze the current role of TC comparing different results between young and elderly patients.

During the period 1990–2012, 76 patients were operated on TC for cancer. Patients were divided in two groups according to the age [ $<65$  – group A (young) and  $>65$  years old – group B (elderly)] and were compared their systemic and surgical complication, considering the presence of comorbidities, ASA score, lifestyle habits, elective or emergency presentation.

Morbidity rate was 7.7% and 38.8% in young and elderly patients respectively.

21 systemic complications (3 in group A and 18 in group B) occurred in 17 patients (22.36%) (with the coexistence of two complications in 4 patients belonging to the group B. There were 6 surgical complications (7.9%) (3 in group A and 3 in group B): anastomotic leakage 3, major wound infections 2, postoperative bleeding 1; no intra-abdominal abscess were observed. In 2 cases (2.6%) (1 anastomotic leak and 1 intra-abdominal postoperative hemorrhage) was needed a reoperation.

We observed only 2 deaths in the elderly.

High ASA score and emergency were associated with worst results. Systemic complications were more frequent in elderly patients cause of significant comorbidities, while the incidence of surgical complications was similar and according to literature.

Besides the classic indications, it is a viable surgical option also in cancer associated with complicated diverticulitis. Our data show that TC is a safe and effective procedure providing good results even in elderly patients, when combined with a careful preoperative evaluation and age is not an absolute contraindication to this procedure.

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**Abbreviations:** TC, total colectomy; FAP, familial adenomatous polyposis; IBD, intestinal bowel disease; CRC, colorectal cancer; HNPCC, hereditary non-polyposis cancer; RCU, ulcerative rectocolitis; IRA, total colectomy + ileo-rectal anastomosis; PCT, proctocolectomy + definitive ileostomy; IPAA, restorative proctocolectomy + ileoanal anastomosis and interposition of ileal reservoir; AMI, acute myocardial infarction; PTE, pulmonary thromboembolism; BMI, body mass index; ASA, American Society of Anesthesiologists; COPD, chronic obstructive pulmonary disease; ESRD, end stage renal disease; TPN, total parenteral nutrition.

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## 1. Introduction

In the last years the incidence of colorectal cancer (CRC) has increased in our population and more and more patients, even in advanced age, may need surgical treatment.

The surgeon has to choose between a limited colectomy or a more extensive resection, such as a total colectomy. There are many factors that can influence this decision, including the presence of familial syndrome (FAP, HNPCC), or an emergent obstructed colon.

Total Colectomy, is the removal of the entire large bowel, with or without intestinal continuity restoration [(i.e. TC + ileo-rectal anastomosis (IRA), total proctocolectomy and ileoanal anastomosis with the interposition of an ileal pouch (IPAA), total proctocolectomy with definitive ileostomy (PCT)].

The aim of this report is to review literature and our experience for understanding the current role played by age, with some associated factors, and the elective and emergency surgery, that influence morbidity and mortality in patients candidate to TC.

## 2. Material and methods

From an overall series of 185 patients operated on TC for benign (FAP, IBD, ischemic colitis) and malignant conditions during the period 1990–2012, we selected 76 CRC affected patients [(aged 38–81 years old), m/f ratio = 1.2].

Data were collected from clinical records for all patients undergoing a total colectomy for cancer in our institute in an over 20-ys period.

According to the age we divided the patients in two groups:

Group A) 39 patients younger than 65 y.o. (range 38–65) m/f ratio = 1.2.

Group B) 37 patients older than 65 y.o.(range 66–85) m/f ratio = 1.2.

Data points included: patient demographics, comorbidities, operative details, clinical presentation, postoperative complications and mortality. In all patients we analyzed the presence of comorbidities (obesity, cardiovascular diseases, respiratory, kidney or liver disease, dyslipidemia, diabetes), lifestyle habits (smoking, alcohol abuse) and ASA grade, elective or emergency surgery.

Systemic one (pulmonary, cardiac, renal and liver failure, pulmonary embolism, urinary tract infections) and surgical complications (anastomotic leakage, abdominal bleeding, and wound infection) have been related to the state of preoperative ASA score and to tumor presentation at diagnosis (elective or emergency colectomy).

Statistical analysis was evaluated with chi square test considering a confidence interval of 95% and a significance for values of  $p < 0.005$  between groups.

## 3. Results

76 patients [(aged 38–81 years old), m/f ratio = 1.2] were operated on TC for cancer.

Comorbidities in group A and group B are indicated in Table 1. Many patients contemporaneously presented at the same time more than one disease. Cardiovascular diseases were the most frequent comorbidities in both groups (with significative higher incidence in elderly) followed by respiratory and renal failure. More patients in group B presented a high ASA score; 46.1% and 67.5% had a score > III in group A and B respectively ( $p = 0.06$ ). Instead, higher rates of smoke or of alcohol abuse were mainly found among young ones.

IRA 66 (53 handsewn side-to-end anastomosis and 13 mechanical end-to-end anastomosis), PCT 5 and IPAA 5 (all handsewn suture) were performed in open surgery. No patient had diverting

**Table 1**

TC for cancer (76 pts.): comorbidities, ASA score and lifestyle habits in young (group A) and elderly patients (group B).

	Group A (39)		Group B (37)	
	n	%	n	%
<i>Comorbidities</i>				
Obesity	4	10.25	5	13.5
Cardiovascular disease	11	28.2	30	81
Respiratory disease	4	10.25	14	37.8
Nephropathies	2	5.12	9	24.3
Liver disease	2	5.12	5	13.5
Dyslipidemia	3	7.7	3	8.10
Diabetes	3	7.7	8	21.6
<i>ASA score</i>				
≤ II	21	53.9	12	32.5
>III	18	46.1	25	67.5
<i>Lifestyle habitus</i>				
Smoke	18	46	11	29.7
Alcohol abuse	10	25.6	4	10.8

loop ileostomies. Surgical procedures according to concomitant pathologies and patient's age are summarized in Table 2.

Recovery of bowel function was on average in the third postoperative day and mean hospital stay was 11.5 days (range 9–23).

Morbidity rate was 7.7% and 38.8% respectively in young and elderly patients.

21 systemic complications (3 in group A and 18 in group B) occurred in 17/76 patients (22.36%) (with the coexistence of two complications in 4 patients belonging to the group B) (Table 3).

Overall mortality was 2.6%, both patients were elderly (group B) and died respectively for acute myocardial infarction (AMI) and pulmonary thromboembolism (PTE).

There were 6 surgical complications (7.9%) (3 in group A and 3 in group B): 3 anastomotic leakage, 2 major wound infections, 1 postoperative bleeding, No intra-abdominal abscess was observed. In 2 cases (2.6%), 1 anastomotic leak and 1 intra-abdominal postoperative hemorrhage, a loop ileostomy and a drainage were respectively performed. There was no statistical difference between the two groups ( $p = 0.946$ ).

Higher ASA score and emergency presentation were associated to higher rates of systemic and surgical complications (Table 4).

43/76 patients had and ASA > III score and 14 (32.5%) out of them [3 (16.6%) in group A and 11 (44%) in group B] had systemic complications, likewise 83.3% of surgical complications verified in patients with ASA >3 score too.

11/30 (36.6%) operated on emergency had systemic complications, compared to 13% of morbidity rates in elective surgery. In aged patients systemic and surgical complications rates varied between elective and emergency increasing from 23.8% (5/21 pts.)

**Table 2**

Surgical procedures according to pathologies and patient's age.

	Group A (39)			Group B (37)			Total
	IRA	PCT	IPAA	IRA	PCT	IPAA	
Cancer on FAP	–	3	1				4
HNPCC	10			8			18
Cancer on IBD		2	1				3
Synchronous tumors	4		3	10			17
Emergency presentation	14			16			30
Cancer and complicated concomitant diverticulitis	1			3			4
Total	29	5	5	37			76

IRA = total colectomy + ileo-rectal anastomosis; PCT = proctocolectomy + definitive ileostomy; IPAA = restorative proctocolectomy + ileoanal anastomosis and interposition of ileal reservoir.

**Table 3**  
Systemic and surgical complications after 76 TC for cancer.

Systemic complications	Group A (3)	Group B (14)
Lower urinary tract infection (UTI)	3	4
Respiratory complications	–	6
Cardiac failure	–	3
Pulmonary embolism (PTE)	–	1
Acute renal failure	–	3
Liver failure	–	1
Surgical complications	Group A (3)	Group B (3)
Anastomotic leakage	1	2
Hemorrhage	1	–
Major wound infections	1	1

to 56.25% (9/16 pts) and from 4.76% (1/21 pts) to 12.5% (2/16 pts.) respectively. The systemic complications are statistically significant in group a ( $p = 0.047$ ) and b: ( $p = 0.017$ ), while surgical complications in the two groups are not statistically significant ( $p = 0.658$  in group A and  $p = 0.626$  in group B).

#### 4. Discussion

Our specific interest on colo-rectal surgery, and particularly on TC for benign disease (FAP, IBD) [9–18] and for cancer, with a first review concerning a 10 years-experience [19], led us to examine our whole experience in a period of more than 20 years.

In recent years TC for cancer has carved out a role in selected cases, attracting many researcher's attention. Several studies compared surgical, functional and oncological results between TC and "typical" segmental colectomy [1–5] and between open and laparoscopic procedures [1–8] without significant differences.

Emergency subtotal or total colectomy has been considered for cancer treatment, as it achieves in one-stage relief of bowel obstruction and tumor resection by encompassing a massively distended and fecal-loaded colon with ischemic lesions and serous tears on the cecum. It ensures restoration of intestinal continuity, via a "safe" ileocolonic anastomosis, and removes occasional proximal and distal lesions to the index cancer, when in emergency presentation is not possible to perform a colonoscopy.

The treatment of acutely obstructed carcinoma of the left colon still represents a matter of controversy. Traditionally, left-sided acute bowel obstruction is treated by a staged procedure, because immediate resection and anastomosis, in a massive distended and unprepared colon, carries a high complication rate [20–24]. The cumulative morbidity and mortality of staged procedures, however, are so high that justified a less conservative surgery [20–24]. Several recent studies have been published advocating the advantages of primary resection with immediate anastomosis, after decompression and cleansing of the obstructed colon [2,25–28].

Currently TC is also indicated for cancer at diagnosis of FAP or IBD, HNPCC, synchronous or sporadic tumors [29]. In our experience we observed high frequencies of inherited disorders in younger patients and in emergency presentation in elderly. Apart from the common indications, we decided to perform TC even in presence of other benign pathologies involving the entire colon (i.e.: proximal cancer + complicated distal diverticulitis) associated to CRC.

Some researchers have pointed out their attention on preoperative factors, that may increase morbidity and mortality, such as laboratory parameters (presence of ascites, serum sodium > 145 mEq, ASA grade, and a low serum albumin) or presentation at diagnosis (i.e. obstruction, perforation, lower gastrointestinal bleeding).

An interesting study from Klima [32] in 2012, identified 17 statistically significant factors between the patients who died and those who lived after all kind of colectomies. These factors included age, BMI, COPD, ESRD, mild renal insufficiency, peripheral vascular disease, need for surgery within 24 h of presentation, high ASA grade, perforated viscus, obstruction, requirement for blood transfusion, open surgery, prolonged OR time, postoperative complication, colectomy location, diagnosis code (ischemia), and the need for subtotal colectomy. Using stepwise logistic regression, six factors were identified as independent predictors of mortality: ASA grade, age, urgent case, subtotal colectomy, open resection, and preoperative obstruction. Interestingly, diagnosis code and BMI had no bearing on 30-d mortality.

Three main factors were nearly seen in every study [30–33] ASA score, emergency colectomy, and age – as the most important predictors of mortality. In our series we focused on patient's general health conditions and cancer presentation (emergency surgery), which has a relevant role in determining postoperative complications.

Preoperative evaluation revealed, as expected, more comorbidities in elderly with reversed trend to some lifestyle habits (smoking and alcohol consumption). Consequently, it is easy to understand that systemic complications were more frequent in elderly patients and the incidence of these complications was directly related to the distribution of preoperative pathologies.

Surgical complication rates were comparable in the two groups. Anastomotic leak occurred in 3 cases (4.3%) [1 (2.9%) in group A and 2 (5.4%) in group B], 2/3 resolved with fasting and total parenteral nutrition (TPN). Wound infection was a case-by-side, and was always found after emergency procedures. In 2 cases a reoperation was performed: 1 relaparotomy for postoperative intra-abdominal bleeding in group A, and 1 temporary ileostomy for anastomotic leak in group 2.

Average 30-d in-hospital mortality following all kind of colectomy (segmental and total) has a wide variation in the literature ranging from 0% to 80% [33–37]. Multiple studies have helped to identify risk factors for mortality in specific populations of patients. Age, the need for emergent operation, and preoperative American Society of Anesthesiology score (ASA) have commonly been identified as major risk factors increasing mortality as much as 2- to 11-fold [32,33,38–41]. In some countries this may contribute to general surgeons having a higher mortality postoperatively than reported by colorectal surgeons, given the greater number of emergent presentations with which general surgeons must deal.

Emergent colectomy has been defined differently in a number of studies, making it difficult to standardize what a true emergency in colectomy surgery (emergent – within 2 h – and urgent cases – within 24 h) The need for emergent surgery may increase the rate of death as much as 11-fold [30,33]. In our series 2 patients died after TC, both among elderly patients (AMI and PTE), who already had significant preoperative risk factors and were operated on occlusive cancer. Mortality rate among elderly patients was, therefore, 5.4%, in line with other reports [1–5], but it amounts on 12.5% among those operated on emergency.

The average hospital stay was quite similar in two groups: 10 and 11 days respectively for group A and B.

We strongly agree with Kilma [30] who has stated that the improving outcomes in patients undergoing colorectal resection is a difficult task but starts with determining one's outcomes and improving upon weaknesses. Informing patients and their families of the overall prognosis is important in screening patients for surgery and weighing the risks associated with a particular procedure.

Patients undergoing elective procedures must receive an appropriate work-up and medical optimization to stabilize the physiologic factors noted commonly in previous predictive models.

**Table 4**

TC for cancer: analysis of complications related to patient's ASA score, elective and emergency surgery.

	Overall	Group A	Group B
<i>Systemic complications (17)</i>			
ASA ≤ II	3/33 (9%)	–/21	3/12 (25%)
ASA ≥ III	14/43 (32.5%)	3/18 (16.6%)	11/25 (44%)
Elective surgery	6/46 (13%)	1/25 (4%)	5/21 (23.8%)
Emergency	11/30 (36.6%)	2/14 (14.3%)	9/16 (56.2%)
<i>Surgical complications (6)</i>			
ASA ≤ II	1/33 (3.03%)	1/21 (4.7%)	–/12
ASA ≥ III	5/43 (11.6%)	2/18 (11.1%)	3/25 (12%)
Elective surgery	3/46 (6.5%)	2/25 (8%)	1/21 (4.7%)
Emergency	3/30 (10%)	1/14 (7.1%)	2/16 (12.5%)

Even more importantly, elderly patients undergoing colon resection for any reason need to understand the benefits and risks of their procedure as well as any available medical management strategies.

Patients with an ASA score  $\geq 3$  and those with acute emergency are oftentimes not afforded the opportunity of an appropriate workup and stabilization.

## 5. Conclusions

TC has currently a well established role even in cancer treatment. Presence of cancer associated to FAP or RCU, HNPCC, synchronous sporadic CRC, emergency presentation are the main indications with as good results as after typical resections. Currently it should be emphasized that the safety and the good results linked to TC also in oncologic diseases has allowed us to extend its indications, in selected cases, even to different conditions such as the presence of proximal cancer associated with benign distal pathologies (i.e. right colon cancer + diffuse distal diverticulitis).

Morbidity and mortality rates are slightly higher in the elderly and Higher ASA. These data are acceptable and are not statistically significant. Comorbidities play a relevant role, because, as predictable, oldest people often present more and much serious pre-operative pathologies.

Our experience further confirms that TC may be a safe procedure even in elderly. A cautious patient's selection with careful preoperative evaluation of comorbidities and an appropriate pre-operative preparation are strongly needed to improve surgical results.

## Ethical approval

The manuscript concerns an observational and retrospective study, so it doesn't require Ethical Approval.

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## Author contribution

**Nicola Carlomagno:** Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data; also participated substantially in the drafting and editing of the manuscript.

**Michele L. Santangelo:** Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

**Bruno Amato:** Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

**Armando Calogero:** Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

**Michele Saracco:** Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

**Cristiano Cremonese:** Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

**Agnese Miranda:** Participated substantially in conception, design, and execution of statistical analysis.

**Concetta Dodaro:** Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data.

**Andrea Renda:** Participated substantially in conception, design, and execution of the study and in the analysis and interpretation of data; also participated substantially in the drafting and editing of the manuscript.

## Conflicts of interest

All Authors have no conflict of interests.

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