

Impact of Emergency Surgery in the Outcome of Rectal and Left Colon Carcinoma

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Abstract

The negative results in terms of morbidity, mortality and survival among emergency treated patients affected by colorectal cancer are well known. The specific contribution of emergency surgery to adverse outcome is not clear because of the presence in all series of other possible determinants of a poor prognosis. We used a case-control study design to compare a group of 50 patients operated on for cancer of the rectum and left colon presented as emergencies in our department during the last 14 years, and an equal number of patients who underwent elective procedures during the same period. All records of these patients were reviewed and matched for age, stage, tumor location, and medical comorbidities (coronaropathy, diabetes mellitus, cerebral vascular deficiency, chronic obstructive pulmonary disease). Outcome measures included length of hospital stay, morbidity, mortality, and actuarial 5-year survival. Univariate and multivariate analysis of factors potentially influencing survival was performed on the entire population of 100 patients. Age, tumor location, stage of disease, and medical comorbidities were well matched by intent of the study design. Overall surgical morbidity (44% versus 12% $P = 0.0004$), length of hospital stay (16, 64 versus 10, 97 days $P = 0.0026$) and postoperative mortality (4% versus 0% $P = 0.4949$) resulted higher in the emergency group. Actuarial overall 5-year survival was not different between the two groups. The only variables independently predictive of survival in multivariate analysis were age and rectal location of the tumor. Postoperative surgical mortality and long-term survival appear not to be influenced by emergency presentation of colorectal cancer; the negative impact of the emergency procedures is confined to the immediate postoperative period and is probably connected to the acute medical pathology often presented by patients in emergency situations. Dealing with this kind of patient's accurate preoperative assessment and solution of acute medical pathologies before surgical treatment are mandatory.

Patients affected by colorectal cancer present as surgical emergencies in a percentage ranging from 11% to 43% of cases.¹ A more detailed analysis of emergency cases reported in the literature, shows how complete obstruction is the most frequent condition (8%–40% of cases),^{2,3} followed by perforation (2%–22% of cases)^{4–6} and hemor-

rhage. Emergency surgery is generally associated with higher morbidity and mortality rates as well as poorer long-term prognosis, as compared with elective procedures. These higher rates are probably connected to many factors related to the emergency condition itself, but they may also be related to patient characteristics and preoperative health state, technical difficulties, and stage of the disease.^{1,6–8}

Smothers *et al.*,⁸ have recently published the first case-control study on this subject, which, by means of extremely

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precise definitions and inclusion criteria, together with accurate balancing of patient characteristics and treatment variables, allowed the authors to stress the role of emergency surgery as an independent negative prognostic factor in terms of morbidity and surgical mortality. On the other hand, we have already published the results of a study based on the retrospective analysis of a series of emergency patients treated for left colon malignancies. In it, we aimed to identify medical conditions that can affect short-term results and proposed a new scoring system to enable better selection of patients for the various surgical options.⁹ We found it interesting to use the case-control methodology proposed by Smothers *et al.*⁸ to verify the role of emergency surgery itself as prognostic factor in our series, which included a larger number of patients with tumors of the left colon and rectum.

MATERIALS AND METHODS

The electronic medical records of all patients operated for rectum and left colon cancer from 1990 to 2003 in our department were reviewed. Of the 787 patients identified, 50 had undergone emergency procedures for occlusion, perforation, or hemorrhage. The emergency criteria were defined as follows: total absence of flatus or bowel movements for at least one day accompanied by clinical signs (nausea, vomiting, painful and distended abdomen) and plain film of the abdomen confirming complete bowel obstruction; history and examination consistent with colonic perforation with consequent peritonitis or intra-abdominal abscess and/or signs and symptoms of sepsis (fever, high white blood cell count, hemodynamic instability); active and massive bleeding with failure of endoscopic treatment. All patients were operated on within 24 hours of admission by senior surgeons, as in the elective cases. The 50 patients included in the study on the base of such criteria were matched for age, tumor location, stage, and comorbidities with another 50 patients who underwent elective procedures during the same period.

Collected data included:

- Comorbidities considered for matching groups were defined as follows: coronary artery disease: prior myocardial infarction as evidenced by the ECG or cardiac catheterization with evidence of coronary narrowing or prior coronary artery bypass; diabetes mellitus: hyperglycemia requiring oral hypoglycemic drugs or insulin; cerebral vascular deficiency: radiological documentation of stroke with residual neurological deficits; chronic obstructive pulmonary disease: prior pulmonary function testing consistent with obstructive pattern;

- tumor variables such as location (rectum, sigmoid or descending colon) and stage, according to the TNM classification;
- treatment variables with specific regard to type of operation performed and possible adjuvant therapy.

Outcome measures included length of hospital stay, morbidity, postoperative mortality (death within 30 days of operation, regardless of length of hospital stay, or any death that occurred before discharge, regardless of timing), and actuarial 5-year survival.

Comparison of categorical variables was performed by chi-squared analysis or the Fisher exact test where appropriate. Normally distributed variables were analyzed with the Student's *t*-test. The cutoff for significance was set at $P < 0.05$. Odds ratio (OR) and 95% confidence intervals were calculated with the Mantel-Haenszel common OR estimate. The Survival was estimated by the Kaplan-Meier method. The log-rank test was used to analyze the difference between the survival curves. All analyses were performed with Statistica for Windows (StatSoft Inc, Tulsa OK).

RESULTS

Age, gender, tumor location, medical comorbidities, and stage of disease were well matched between the two groups by intent of the study design.

In both groups the most frequent location of the tumor was the sigmoid colon (31 cases in the emergency group, 28 cases in the elective one), followed by descending colon (11 cases and 13 cases, respectively), and rectum (8 cases and 9 cases, respectively). TNM classification for the two groups was as follows: stage II, 21 cases; stage III, 17 cases; and stage IV, 12 cases.

The indication for emergency surgery was bowel obstruction in 42 cases, perforation in 7 cases, and massive bleeding in 1 case; of these patients, 30 underwent one-stage resection (in 10 cases a protective colostomy was necessary), 15 underwent Hartmann's procedure, and the remaining 5 had a diverting colostomy. When one-stage resections were performed in cases of obstruction, we seldom used on table lavage, and only in the early years of our experience. In more recent years, we often performed simple colonic decompression. The anastomotic leak rate was 7% (2 cases). In the elective group, the number of one-stage resections was obviously higher (44 patients). No anastomotic leakage was noted, but a protective colostomy was necessary in 2 cases (4, 6%). In one case only we decided to perform a Hartmann's procedure. In the remaining 5 cases resection of the tumor was not feasible,

Table 1.
Type of operation performed

Type of operation performed	Emergency surgery	Elective surgery
Anterior resection	5	26
Left hemicolectomy	14	6
Resection of the sigmoid	5	12
Total colectomy	6	/
Hartmann's procedure	15	1
Colostomy	5	4
Explorative laparotomy	/	1

and the patients were submitted to diverting colostomy (4 cases) or explorative laparoscopy (1 case) (Table 1). Preoperative mechanical preparation with polyethylene glycol (PEG) or oral phosphate solutions was used in all cases.

Antibiotic prophylaxis with ceftriaxone and metronidazole was used routinely both in elective and emergency cases, and it was extended to 48 hours postoperatively. The use of adjuvant treatment did not differ significantly between the two groups. All data are summarized in Table 2.

Overall morbidity and, in particular, respiratory insufficiency, was higher in the emergency group (44% versus 12%, $P = 0.0004$ and 14% versus 0%, $p 0.013$, respectively) (Table 3). The same was true of the length of hospital stay (16, 64 days versus 10, 97 days, $P = 0.0026$). Postoperative mortality was also higher in the emergency group, but the difference was not statistically significant (4% versus 0%, $P = 0.495$). In the univariate analysis of actuarial overall 5-year survival in the entire population of 100 patients, the only factors predictive of survival were tumor location (52.9% for tumors located on the descending colon and the sigmoid versus 19.4% for rectal location, $P = 0.0007$), age (63.2% in patients under median age—68.5 years—versus 26.7% in those over the age of 68.5 years, $P = 0.004$), coronaropathy (56.1% versus 32.1%, $P = 0.017$), and stage of the tumor (55.8% for stage 2 versus 38.3% for stage 3–4 $P = 0.026$); no difference in survival rate was seen between patients who underwent emergency surgery and those who were operated on as an elective procedure. The only variables that were confirmed as independently predictive of survival in the multivariate analysis were age and tumor location; stage of the disease would probably be independently significant in a larger series. Survival curves of the entire population according to age, tumor location, and modality of surgery, are illustrated in Figures 1, 2, 3.

DISCUSSION

Despite wide availability of colorectal cancer screening and surveillance programs, the rate of emergency presen-

tation is still high, although with an extremely variable percentage in the various series reported (from 11% to 43% of patients affected).¹ This disparity in reporting is probably due in some degree to the different characteristics of the hospital receiving the patients and the social and health delivery systems of the countries from which the reported series originate.¹ In our series emergency presentation accounts only for 6.3% of all cases operated for rectum and left colon cancer in the last 13 years; this rate, lower than those normally reported in literature, reflects the predominance of elective admission in our department.

Although much of the literature on the association between emergency surgery for colorectal cancer and prognosis has reported contradictory results, many authors have stressed the association between emergency procedure and poor outcome, in terms of morbidity, mortality, and long-term survival.^{1,6–11} Tobaruela *et al.*,¹ in their review of 51 patients operated for occlusive or perforated colorectal cancer, found morbidity and mortality rates of 41% and 14%, respectively, with a statistically significant association with American Society of Anesthesiologists (ASA) grading and acute physiology component of the APACHE II score (temperature, arterial blood pressure, heart and respiratory rates, oxygenation, pH, serum potassium and creatinine, hematocrit, and leukocyte count). Overall survival was also extremely poor, resulting in 15% at 62 months. The retrospective study recently published by Ascanelli *et al.*,⁷ confirmed these data by means of a comparison between a series of 118 patients operated on for colorectal cancer presented as emergencies, and an equal number of patients who underwent elective procedures. These two groups of patients were well matched for age, sex, tumor location, and stage of disease. The 30-day operative mortality rate reported was higher in the emergency group than in the electively treated group (11.9% versus 3.4%), as well as the 30-day operative morbidity (27.1% versus 12.7%). Also, the 5-year survival rate was greater after elective surgery (59% versus 39%).

This condition has been attributed with different emphasis to many factors that can be schematically divided into surgical and medical ones.¹ The first are strictly related to the tumor characteristics, such as stage, location, type of emergency picture at presentation, and surgical options adopted; the second are connected to the characteristics of the patient such as age, past medical history, and health status at the time of the procedure. The real impact on outcome of the various parameters considered is often underestimated or overestimated because of lack of precise definition of the emergency condition described¹² and accurate balancing of factors potentially influencing

Table 2.
Patients characteristics and tumor and treatment variables in the two groups

	Emergency surgery	Elective surgery
Median age	68 years (range: 36–90 years)	68 years (range: 36–90 years)
Diabetes mellitus	11/50 (22%)	9/50 (18%)
Coronary artery disease	22/50 (44%)	23/50 (46%)
COPD	12/50 (24%)	12/50 (24%)
Cerebral vascular deficiency	1/50 (2%)	1/50 (2%)
Stage I	0	0
Stage II	21/50 (42%)	21/50 (42%)
Stage III	17/50 (34%)	17/50 (34%)
Stage IV	12/50 (24%)	12/50 (24%)
Resection of tumor	45/50 (90%)	45/50 (90%)
Adjuvant chemotherapy	19/50 (38%)	14/50 (28%)

COPD: chronic obstructive pulmonary disease.

Table 3.
Overall morbidity

Complications	Emergency surgery	Elective surgery	P Value
Wound infection	4 (8%)	1 (2%)	0.362
Bowel obstruction	2 (4%)	2 (4%)	NS
Anastomotic bleeding	1 (2%)	0	NS
Colostomy	1 (3%)	0	0.375
Pneumonia	4 (8%)	1 (2%)	0.362
Renal insufficiency	1 (2%)	2 (4%)	NS
Respiratory insufficiency	7 (14%)	0	0.013
Surgical Mortality	2 (4%)	0	0.495
Total	22 (44%)	6 (12%)	0.0004

outcome.⁸ Nevertheless, scoring systems such as POSSUM and P-POSSUM have been widely used and validated, and they represent, at the moment, the most reliable methods of measuring risk-adjusted outcomes in patients undergoing colorectal surgery.¹³ More recently, a simplified POSSUM scoring system specific for colorectal surgery, the CR-POSSUM, has been introduced, but it needs for further validation.¹⁴

Although based on a more limited series, we recently published the results of a study that allowed identification of four parameters (chronic renal failure, low albumin serum levels, heart disease, and colon perforation as emergency presentation) that proved to be independently predictive of negative early outcome in emergency-treated patients with left colon malignancies.⁹ We consequently proposed a new scoring system (the Colorectal Tumors Emergencies Score—CTES) based on these four parameters, which served to classify the patients in three different risk groups for postoperative morbidity and mortality. Our scoring system awaits prospective validation. If compared to the above-cited POSSUM and P-POSSUM models, it cannot be considered an alternative for measuring risk-adjusted outcomes, especially if the results are intended as

a mean of monitoring standards of care among healthcare providers. It is, however, useful as a new and easily applied tool for operative risk evaluation and as a tool with which to establish the best surgical approach in each case.

The first case-control study aimed at clarifying the specific influence of emergency procedures on the outcome of patients with colorectal disease, has recently been reported by Smothers *et al.*⁸ The authors compared morbidity, operative mortality, and survival between two groups of 29 patients each, who underwent surgery for colorectal cancer as an elective or emergency procedure. The use of extremely precise definitions and inclusion criteria, and the accurate balancing of patient characteristics such as age, gender, and past medical history, as well as of tumor types and treatment variables—location, stage, percentage of tumors resected and adjuvant therapy performed—allowed the authors to stress the role of emergency surgery alone as an independent negative prognostic factor. They presented their results in terms of morbidity (64% in the emergency treated group versus 24% in the electively treated group, $P = 0.009$) and surgical mortality (34% in the emergency-treated group versus 6.9% in the electively treated group, $P = 0.029$).

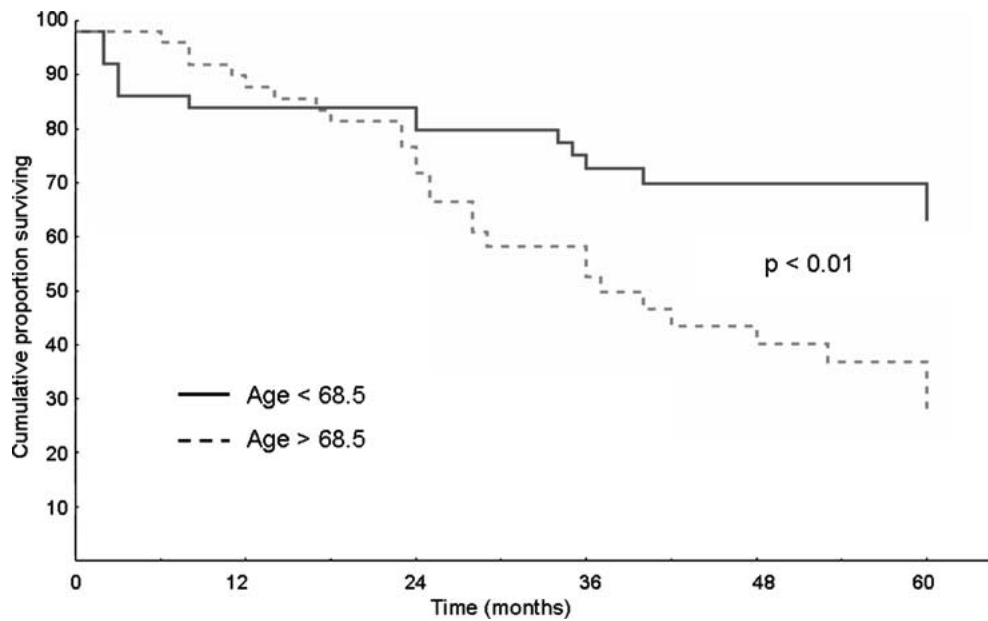


Figure 1. Survival curve according to age.

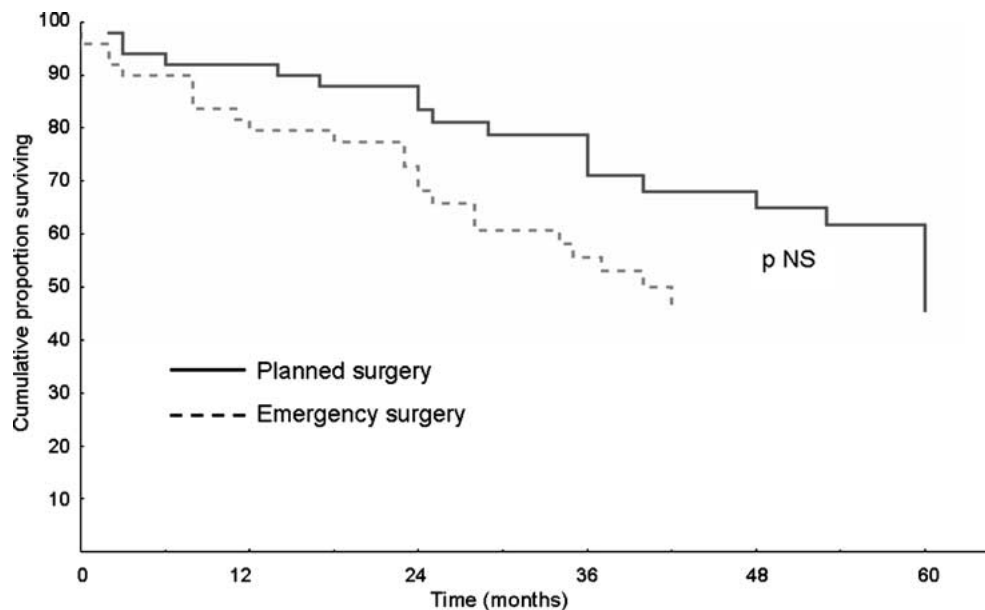


Figure 2. Survival curve according to emergency versus elective surgery.

Our experience has been focused on rectum and left colon tumors, and our study included a larger number of patients. We decided to exclude right-sided lesions because we think that if resection and primary anastomosis is widely accepted as the treatment of choice in cases of obstructive right colon cancers,¹⁵⁻¹⁷ then the debate about which is the best surgical option in cases of left-sided lesions remains open. Our series, which includes all kinds of possible surgical treatments, from one-stage to multistage resections, presents a clear image of this troubling situation. If we analyze the evolution of our surgical approach

in recent years, we can say that, at the moment, one-stage resection is the operation of choice in almost all cases, with a diverting stoma performed only in cases of anastomotic tension, incomplete doughnuts, or leakage on hydro-pneumatic testing. We reserve Hartman's procedure for high-risk patients when it is not possible to resolve acute preoperative medical pathologies.

As a consequence of the increasing number of one-stage resections performed in cases of obstructive left colon malignancies, the role of mechanical bowel preparation, preoperative or intraoperative, as well as of antibiotic

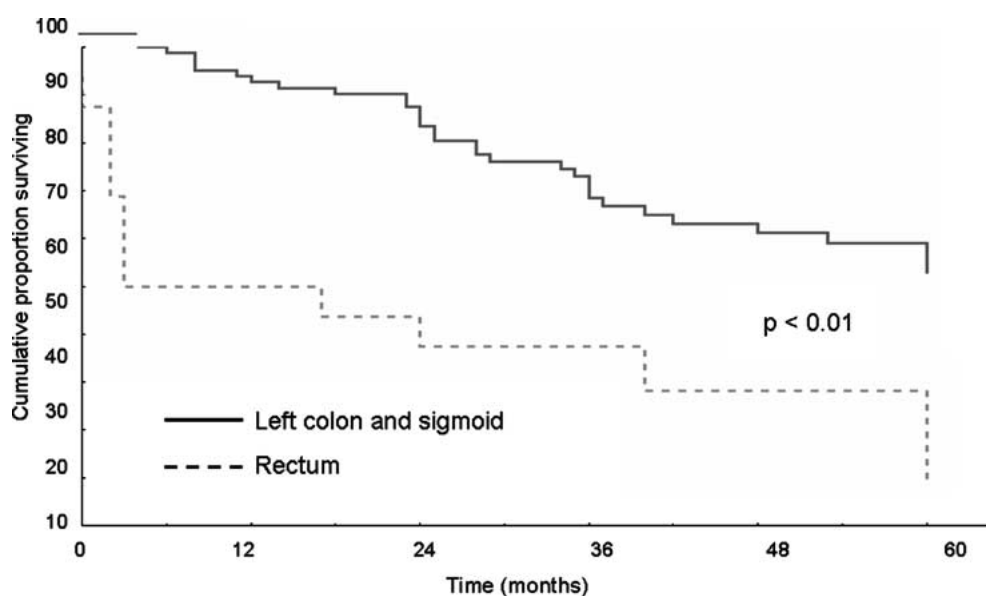


Figure 3. Survival curve according to the location of the tumor.

prophylaxis, in reducing morbidity and mortality, has been widely investigated. Our choice is to perform mechanical bowel preparation with PEG or oral phosphate solutions routinely in elective cases, thus reflecting a widely used approach among American colorectal surgeons,¹⁸ although there has been no demonstrated advantage in using this approach.^{19–22} In the emergency setting, on-table lavage has not demonstrated real advantages in terms of reduction of anastomotic failure, and it may increase spillage and contamination;²³ we have therefore abandoned use of this procedure in the recent years. We prefer a simple colonic decompression, which improves the blood supply to the colonic stump and makes closure of the abdomen easier.²⁴

A remaining issue is the role of antibiotic prophylaxis in preventing septic complications. We believe that it is essential in colorectal surgery—even more so in the emergency setting—and we routinely used a third-generation cephalosporin + metronidazole, and we extend its use for 48 hours postoperatively. The value of this conviction is supported by the results of a recent meta-analysis of published series about antibiotic prophylaxis in colorectal surgery, which demonstrated its efficacy in preventing wound sepsis, and reported almost unanimous agreement among US colorectal surgeons concerning its efficacy.¹⁸

Another reason that led us to focus on left-sided lesions was the necessity to satisfy an opportunity criterion strictly connected to the nature of the study design. By definition, a case-control study is based on a comparison of two groups of patients, each of which is included only if it meets extremely precise criteria according to strictly defined parameters. Because the greater number of patients submitted to both elective and emergency surgery for

colorectal cancer recorded in our electronic database had left colon malignancies, it was easier to identify 50 patients responding to the above-mentioned criteria for inclusion in the two groups. Thus, definitions and inclusion criteria, as well as balancing of factors potentially influencing outcome among elective and emergency-operated patients, have been even more precise than those reported in the article by Smothers *et al.*⁸ Furthermore, our results confirm and enforce their results.

In particular, in our series, morbidity and mortality were four times more likely in patients treated by emergency procedures, although the mortality data were not statistically significant. This tendency to a higher morbidity rate in the emergency-treated group reflects also on the median length of hospital stay, which was 6 days longer for emergency-treated patients than for the electively treated patients ($P = 0026$). No differences in long-term survival curves were observed between the two groups, as has been found by many other authors,^{6,25–28} suggesting that this parameter is more likely connected to the natural history of the disease than to the treatment approach.⁸

CONCLUSIONS

Our data seem to confirm that an emergency procedure in and of itself is a factor negatively influencing early outcome in terms of overall morbidity and length of hospital stay for patients with left-sided colorectal lesions. This observation is not confirmed for survival, which is probably connected with the natural history of the disease. A possible explanation for these results could be found in the study by

Tobaruela *et al.*,¹ who observed a statistically significant association between the acute physiology component according to the APACHE II system and postoperative morbidity and mortality. In other words, we agree with Scott *et al.*,²⁹ who said the main factor that influences poor prognosis in emergency treatment of the patient is that the patient is sicker than the patient undergoing elective treatment. If this is true, we think that it could be advisable to improve efforts in accurate preoperative assessment in order to resolve acute medical pathologies before surgical treatment, better than the option of performing staged procedures, which probably cannot provide better morbidity and mortality rates.⁷

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