

## Challenges and Solutions in Choosing the Surgical Treatment in Patients with Complicated Colon Cancer Operated in an Emergency – A Retrospective Study

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### Rezumat

*Provocări și soluții în alegerea tratamentului chirurgical la pacienții cu cancer de colon complicat operat în urgență – studiu retrospectiv*

*Introducere:* Alegerea tratamentului optim pentru pacienții cu cancer de colon complicat operat în urgență rămâne o provocare. Scopul studiului este de a identifica factorii ce influențează decizia terapeutică la pacienții cu cancer colonic complicat operat în urgență.

*Pacienți și metode:* Am inclus în acest studiu retrospectiv 449 pacienți internați și operați în regim de urgență pentru cancer colonic complicat, în Clinicile I și II de Chirurgie Generală ale Spitalului Clinic Județean de Urgență “Sf. Ap. Andrei” din Galați în perioada 2008-2017. Datele pacienților au fost colectate din foile de observație, protocoalele operatorii, imagistice și de laborator, la momentul intervenției de urgență.

*Rezultate:* Operațiile practicate au fost rezecții cu stomă la 37,63%, rezecții cu anastomoză la 36,97%, derivații externe la 16,26%, și derivații interne la 9,13% dintre pacienți. Vârsta avansată s-a corelat cu practicarea unei stome cu sau fără rezecția tumorală ( $p < 0,05$ ). Diagnosticul preoperator de HDI s-a asociat cu rezecția cu anastomoză, cei cu ocluzie s-au asociat statistic cu derivațiile interne, iar cei cu perforații digestive cu rezecții cu stomă ( $p < 0,05$ ). Practicarea unei stome s-a asociat cu prezența complicațiilor decese late intraoperator sau iminența de perforație diastatică ( $p < 0,05$ ).

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*Concluzii:* Tumorile de colon complicate operate în urgență necesită un tratament chirurgical adaptat fiecărui pacient în parte. Este important ca alegerea tipului de tratament să se facă ținând cont de starea pacientului la internare, datele clinico-paraclinice, localizarea tumorală, complicația tumorală precum și prezența altor complicații decelate intraoperator.

**Cuvinte cheie:** cancer de colon complicat, chirurgie de urgență, corelații

## Abstract

*Introduction:* Choosing the optimal treatment for patients with complicated colon cancer operated in an emergency remains a challenge. The study aims to identify the factors that influence the therapeutic decision in these patients.

*Patients and methods:* We included in this retrospective study 449 patients operated in emergency for complicated colon cancer, in the Clinical Emergency County Hospital "St. Ap. Andrei" Galați between 2008-2017. The patients' data were collected from the observation sheets, the surgical, imaging and laboratory protocols.

*Results:* The operations performed were: resections with a stoma in 37.63% of cases, resections with anastomosis in 36.97%, stomas in 16.26% and internal derivations in 9.13% of patients. Elderly age was correlated with stomas with or without tumour resection ( $p < 0.05$ ). Preoperative diagnosis of IDH was associated with resections with anastomosis, those with occlusion were associated with internal derivations and those with digestive perforations with resections with a stoma ( $p < 0.05$ ). The stomas were associated with the presence of intraoperatively detected complications ( $p < 0.05$ ).

*Conclusions:* Complicated colon tumours operated on in an emergency require surgical treatment tailored to each patient. It is important to choose the type of treatment taking into account the patient's condition at admission, clinical-paraclinical data, tumour location, tumour complication and the presence of other complications detected intraoperatively.

**Key words:** complicated colon cancer, emergency surgery, correlations

## Introduction

The GLOBOCAN 2012 analysis places colorectal cancer in second place in Romania, with approximately equal involvement of both sexes, while the most affected decades are the sixth and the seventh (1).

Although there are possibilities for screening and diagnostic tools in the early stages, unfortunately, a large part of patients with colon cancers continue to go to the doctor in the complications phase. The explorations used in colon cancer screening are colonoscopy (endoscopic or virtual), tumour markers and occult bleeding test. The complications of colon cancer are occlusion, perforation and haemorrhage. The most common complication

is occlusion, which occurs especially on the left colon (2).

Intestinal occlusion occurs in 8-23% of colon cancers, 2/3 located in the left colon and 1/3 in the right colon. Some studies show that up to 30% of cases of colon cancer are diagnosed in the occlusive phase. Perforation occurs in 2-9% of all malignant tumours of the colon, being more common at the tumour level than at a distance (3-6). The overall incidence of synchronous tumours is 0.6-12%, most being detected preoperatively - 30-77%, the rest intraoperatively by manual palpation of the colon (7).

The surgical options are multiple and consist of practising an external or internal derivation, the tumour remaining in place; colic resection

with colostomy or resection with anastomosis. The type of intervention must be chosen according to several factors, including the age and general condition of the patients, the location of the tumour, the type of complication, the invasion of adjacent organs, the appearance of the colon overlying the tumour, etc.

There are currently no unanimously accepted protocols for surgery that should be performed in emergency for complicated colon neoplasias (8). For occlusive or perforated tumours of the right colon, a hemicolectomy can be performed with or without a protective ileostomy. For occlusive or perforated tumours of the left colon, Hartmann surgery should be the first intervention. In patients with the severe general condition, hemodynamically unstable, a colostomy can be performed, the excision intervention remaining to be done during in a second intervention. Bleeding tumours should be resected (9). The study aims to identify the factors that influence the therapeutic decision in patients with complicated colon cancer operated in an emergency.

## Material and Method

We performed a retrospective study on a study group of 449 patients who presented in an emergency in the phase of colon cancer complications during 10 years, between 2008-2017, at the Emergency County Clinical Hospital "St. Apostle Andrew" from Galati and who benefited from surgical treatment in the Clinics I and II of General Surgery. The observation sheets, the analysis bulletins, the operative protocols and the pathological registers were analyzed.

Inclusion criteria were: adult patients with complicated malignant tumours of the colon (occlusion, perforation, haemorrhage) hospitalized in the General Surgery Clinics I and II of the Galati County Emergency Hospital, operated in an emergency, during 2008-2017. Exclusion criteria from the study: patients with complicated tumours operated in an emergency where the only laparotomy with biopsy was performed, patients with malignancies of the colon operated on schedule,

patients with benign colon diseases and patients with incomplete medical documents.

The clinical and epidemiological elements followed were: age, sex, environment, personal history, reasons for hospitalization, general condition (ECOG scale), the presence of cachexia and the duration from the onset of symptoms to presentation to a specialist. The paraclinical elements analyzed were: the values of leukocytes, platelets, haemoglobin, hematocrit, glycemia, creatinine, proteins, albumin, the presence of electrolyte disorders, acidosis and coagulation disorders. The results of abdominal radiography and computed tomography were also followed. The intra-operative aspects followed were: the location of the tumour, the presence of synchronous cancers, the presence of local invasion or disseminated liver or peritoneal metastases, based on which the type of surgery was decided. The time elapsed from hospitalization to surgery and the number of hospitalization days were also analyzed. We divided the surgeries as follows: operation type 1 - external derivations, where we included continuous colostomy and cecostomy; type 2 resections with a colostomy, type 3 - internal derivations and type 4 - resections with anastomosis, where we included segmental resections, hemicolectomies and subtotal or total colectomies. Statistical correlations were made between these factors and the type of surgery performed.

## Statistical Analysis

Using the SPSS version 23.0 program, statistical correlations were obtained, indicating the p-value with the Pearson Chi-Square and Likelihood Ratio tests. Statistical conclusions were formulated using a statistically significant difference threshold the p-value <0.05 for all calculations performed.

## Results

The operations performed were resections with colostomy - type 2 (37.63%); resections

followed by anastomosis - type 4 (36.97%) - segmental colectomies, hemicolectomies and subtotal/total colectomies; external derivations (16.26%) - most often the anus was practised continuously on the wand, less often Pezzer cecostomy - type 1 and internal derivations (9.13%) - type 3, represented by ileo-colon anastomosis or colo-colon anastomosis (Fig. 1). Postoperative morbidity was 24%.

The distribution of patients according to sex shows the predominance of men, with a ratio M/F = 274/175. In the studied group, urban patients with a U / R ratio = 292/157 predominated. The distribution by age groups reveals that the most affected decades are the 8<sup>th</sup> and 9<sup>th</sup> (24% and 36.3%, respectively). The mean age of the patients in the study group was 68 years. In the elderly, stomas with or without tumour resection were performed and in those under the age of 68, interventions were performed that included the practice of an anastomosis (internal derivations or resections with anastomosis) ( $p < 0.05$ ) (Table 1).

In terms of symptoms, abdominal pain was present in 96.65% of patients analyzed. Nausea was registered in 88.41% of patients and the absence of intestinal transit in 73.71% of patients. In a lower percentage: vomiting - 46.77%, weight loss - 22.71% and only 3.34% of cases showed hematochezia. All patients who underwent stoma or internal derivations had abdominal pain at admission ( $p < 0.05$ ), those with no intestinal transit were associated with stoma with or without tumor resection ( $p < 0.05$ ), in those with vomiting present, internal derivations were practiced ( $p < 0.05$ ) and in those with hematochezia, resections with anastomosis were practiced ( $p < 0.05$ ) (Table 1).

Most patients (83.74%) presented with intestinal obstruction; 12.69% with perforation in either the tumour place or diastatic and 3.56% with hemorrhagic tumours. In patients diagnosed with IDH, resections with anastomosis were performed, those with occlusion were statistically associated with internal derivations and those with digestive perforations with resections with stomas ( $p < 0.05$ ) (Table 1).

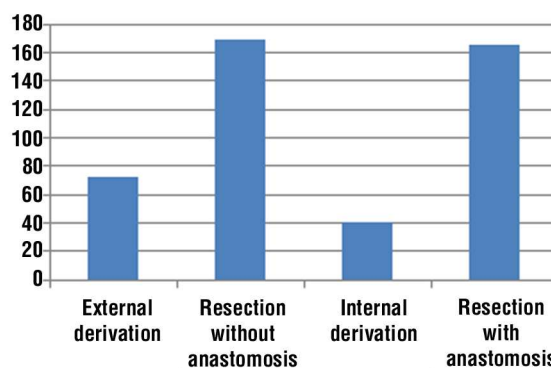


Figure 1. Distribution of patients according to the type of operation performed

Analyzing the length of time in which patients presented to the doctor, we found that 6.45% of patients presented to the emergency department less than 24 hours after the onset of symptoms, 41.20% between 2-5 days after onset, 42.98% within 6-14 days and 9.35% in more than 14 days after the onset of the first symptoms. Patients with symptoms that started in the interval of 2-5 days were statistically associated with internal derivations, in those with onset in 6-14 days a stoma with or without tumour resection was practised and in those with onset more than 14 days, resections with anastomosis were performed ( $p < 0.05$ ) (Table 1).

The general condition at admission was gradually assessed from good to severe according to ECOG performance status. Only 83 patients (18.49%) presented good general condition (ECOG 0), the others showing various changes, as follows: 74 patients (16.48%) had a satisfactory general condition (ECOG 1), 182 patients (40.53%) had an affected general condition (ECOG 2), 77 patients (17.15%) had an altered general condition (ECOG 3) and 33 patients (7.35%) had a severe general condition (ECOG 4). In patients with the good or satisfactory general condition, resections with anastomosis were performed, in those with the affected general condition (ECOG 2), resections with a stoma or internal derivation, and in patients ECOG 3 stomas were performed ( $p < 0.05$ ). In patients with ECOG 4, no associations were

**Table 1.** Correlation of the type of surgery with epidemiological data - statistical data processing

	type operation 1	type operation 2	type operation 3	type operation 4	p_value
Age					0.034264 (1)
>68 years	49/73 (67.1%)	96/169 (56.8%)	18/41 (43.9%)	82/166 (49.4%)	
≤68 years	24/73 (32.9%)	73/169 (43.2%)	23/41 (56.1%)	84/166 (50.6%)	
Sex					0.299314 (1)
F	27/73 (37.0%)	66/169 (39.1%)	11/41 (26.8%)	71/166 (42.8%)	
M	46/73 (63.0%)	103/169 (60.9%)	30/41 (73.2%)	95/166 (57.2%)	
Abdominal pain	73/73 (100%)	166/169 (98.2%)	41/41 (100%)	154/166 (92.8%)	0.004649 (1)
Absence of intestinal transit	63/73 (86.3%)	141/169 (83.4%)	31/41 (75.6%)	96/166 (57.8%)	0.000000 (1)
Vomiting	27/73 (37.0%)	71/169 (42.0%)	27/41 (65.9%)	85/166 (51.2%)	0.008673 (1)
Weight loss	23/73 (31.5%)	41/169 (24.3%)	7/41 (17.1%)	31/166 (18.7%)	0.125473 (1)
Hematochesia	1/73 (1.4%)	1/169 (0.6%)	0/41 (0.0%)	13/166 (7.8%)	0.000567 (2)
Onset					0.000250 (1)
≤1 day	5/73 (6.8%)	6/169 (3.6%)	5/41 (12.2%)	13/166 (7.8%)	
2-5 days	21/73 (28.8%)	68/169 (40.2%)	23/41 (56.1%)	73/166 (44%)	
6-14 days	41/73 (56.2%)	86/169 (50.9%)	11/41 (26.8%)	55/166 (33.1%)	
>14 zile	6/73 (8.2%)	9/169 (5.3%)	2/41 (4.9%)	25/166 (15.1%)	
ECOG scale					0.000000 (1)
0	9/73 (12.3%)	25/169 (14.8%)	4/41 (9.8%)	45/166 (27.1%)	
1	5/73 (6.8%)	17/169 (10.1%)	5/41 (12.2%)	47/166 (28.3%)	
2	20/73 (27.4%)	91/169 (53.8%)	26/41 (63.4%)	45/166 (27.1%)	
3	30/73 (41.1%)	25/169 (14.8%)	1/41 (2.4%)	21/166 (12.7%)	
4	9/73 (12.3%)	11/169 (6.5%)	5/41 (12.2%)	8/166 (4.8%)	
Cashexia=yes	25/73 (34.2%)	40/169 (23.7%)	9/41 (22%)	24/166 (14.5%)	0.006670 (1)
Anemia	52/73 (71.2%)	95/169 (56.2%)	28/41 (68.3%)	121/166 (72.9%)	0.008484 (1)
Sepsis	8/73 (11%)	21/169 (12.4%)	3/41 (7.3%)	9/166 (5.5%)	0.148230 (1)
Rx					0.000800 (2)
0	3/73 (4.1%)	15/169 (8.9%)	2/41 (4.9%)	31/166 (18.7%)	
1	1/73 (1.4%)	13/169 (7.7%)	3/41 (7.3%)	7/166 (4.2%)	
2	67/73 (91.8%)	129/169 (76.3%)	36/41 (87.8%)	121/166 (72.9%)	
3	2/73 (2.7%)	12/169 (7.1%)	0/41 (0%)	7/166 (4.2%)	
Preop. Diag.					0.000000 (1)
H	0/73 (0%)	0/169 (0%)	0/41 (0%)	16/166 (9.6%)	
O	66/73 (90.4%)	138/169 (81.7%)	41/41 (100%)	131/166 (78.9%)	
P	7/73 (9.6%)	31/169 (18.3%)	0/41 (0%)	19/166 (11.4%)	
Admission-Interv					0.003097 (1)
<12 h	36/73 (49.3%)	103/169 (60.9%)	21/41 (51.2%)	73/166 (44.0%)	
12-24 h	19/73 (26.0%)	25/169 (14.8%)	4/41 (9.8%)	25/166 (15.1%)	
>24 h	18/73 (24.7%)	41/169 (24.3%)	16/41 (39.0%)	68/166 (41.0%)	
Tumor location					0.000000 (2)
C18.0	0/73 (0%)	0/169 (0%)	6/41 (14.6%)	36/166 (21.7%)	
C18.2	3/73 (4.1%)	0/169 (0%)	4/41 (9.8%)	13/166 (7.8%)	
C18.3	0/73 (0%)	0/169 (0%)	11/41 (26.8%)	22/166 (13.3%)	
C18.4	5/73 (6.8%)	9/169 (5.3%)	3/41 (7.3%)	24/166 (14.5%)	
C18.5	5/73 (6.8%)	11/169 (6.5%)	12/41 (29.3%)	16/166 (9.6%)	
C18.6	8/73 (11%)	18/169 (10.7%)	4/41 (9.8%)	17/166 (10.2%)	
C18.7	31/73 (42.5%)	103/169 (60.9%)	1/41 (2.4%)	24/166 (14.5%)	
C19.0	21/73 (28.8%)	28/169 (16.6%)	0/41 (0%)	14/166 (8.4%)	
T synchronous	3/73 (4.1%)	1/169 (0.6%)	1/41 (2.4%)	3/166 (1.8%)	0.292146 (1)
I.o. compl =yes	16/73 (21.9%)	15/169 (8.9%)	3/41 (7.3%)	13/166 (7.8%)	0.006321 (1)
Type					0.049516 (2)
A	2/16 (12.5%)	1/15 (6.7%)	0/3 (0%)	4/13 (30.8%)	
BT	0/16 (0%)	0/15 (0%)	1/3 (33.3%)	0/13 (0%)	
IPD	11/16 (68.8%)	6/15 (40%)	2/3 (66.7%)	2/13 (15.4%)	
N	0/16 (0%)	1/15 (6.7%)	0/3 (0%)	1/13 (7.7%)	
ADP	3/16 (18.8%)	7/15 (46.7%)	0/3 (0%)	6/13 (46.2%)	
Organs invasion	27/73 (37.0%)	27/169 (16.0%)	14/41 (34.1%)	17/166 (10.2%)	0.000000 (1)
Metastases	23/73 (31.5%)	35/169 (20.7%)	19/41 (46.3%)	18/166 (10.8%)	0.000000 (1)

1- test Pearson Chi-Square 2 - Likelihood Ratio, operation type 1- colostomy, operation type 2-tumour resection with a stoma, operation type 3- internal derivation, operation type 4- tumour resection with anastomosis Sex F - female, M - male; P - pathological values; Onset - duration from onset to presentation, ECOG - Eastern Cooperative Oncology Group performance status; Rx - simple abdominal radiography, 0 - normal radiography, 1 - aerocolia, 2 - hydroaerial levels, 3 - pneumoperitoneum.; Preopdiag. - preoperative diagnosis, H - haemorrhage, O - occlusion, P - perforation, Int- Interv - the time between hospitalization and surgery, C18.0 - cecum, C18.2 - ascending, C18.3 - hepatic angle, C18.4 - transverse, C18.5 - splenic angle, C18.6 - descending, C18.7 - sigmoid, C19 - rectosigmoid junction, T synchronous - synchronous tumours, - aspects, I.o.compl. - presence of intraoperative complications: A - localized peritoneal abscesses, BT - entero-parietal tumoral block, IPD - imminent diastatic perforation, N - parietal necrosis colon, ADP - acute diffuse peritonitis.

found, statistics possible due to the small number of patients (33 patients). 98 patients (21.82%) presented hospitalized cachexia (estimated by BMI <18.5), which is statistically associated with the practising of a stoma ( $p\_value = 0.006670$ ) (*Table 1*).

Laboratory tests were performed in all hospitalized patients: 203 patients (45.21%) had leukocyte changes, 296 patients (65.29%) had anemia at admission. 66 patients (14.7%) had thrombocytosis / thrombocytopenia, 100 patients (22.27%) had glycemic changes at admission, 177 patients (39.42%) had increases in creatinine, 135 patients (30.06%) had electrolytic disorders, 98 patients (21.82%) metabolic acidosis (blood pH <7.35 and  $HCO_2^- < 22$  mmol / L). 53 patients (11.80%) had coagulation disorders. 41 patients (9.13%) had septic condition at admission (assessed with at least 3 criteria from: fever / hypothermia, chills, altered general condition, hypotension, leukocytosis/leukopenia, metabolic acidosis).

The presence of anaemia reveals a statistical association with resection with anastomosis ( $p < 0.05$ ) (*Table 1*).

The paraclinical investigations performed were simple abdominal Rx-ray, ultrasound exams and computed tomography. All patients underwent abdominal radiography. In 11.35% of patients, this was normal. 5.34% had aerocolia, 78.61% had hydro-aerial levels and 4.67% had pneumoperitoneum. In patients with radiological appearance without changes suggestive of intestinal occlusion or perforation of the digestive tract, resections with anastomosis were performed. The radiological appearance of hydroaerial levels was statistically associated with the practice of a stoma ( $p < 0.05$ ) (*Table 1*).

Most interventions (51.89%) were performed less than 12 hours after admission. 31.85% of patients were delayed for more than 24 hours and 16.25% were operated within 12-24 hours after admission. The intervention performed in the first 12 hours was associated with a stoma resection and those performed at more than 24 hours with resection with anastomosis ( $p < 0.05$ ) (*Table 1*).

Tumour localization analysis, according to

WHO classification, shows that 9.35% were cecum tumours, 4.45% ascending colon tumours, 7.35% liver angle, 9.13% transverse colon, 9.79% splenic angle, 10.46% descending colon tumours, 35.41% sigmoid tumours and 14.03% rectosigmoid junction tumours. For cecum tumours, internal derivations or resections with anastomosis were performed, for those of the ascending colon or the angles of the colon, internal derivations were performed. Tumours of the transverse colon were associated with resection with anastomosis and those of the sigmoid or JRS with Hartman surgery or colostomy ( $p < 0.05$ ) (*Table 1*).

Intraoperatively, in addition to the tumour complication for which surgery was performed, 10.46% of patients also had other complications. Of these, in 44.68% - imminent diastatic perforation, 34.04% acute diffuse peritonitis, at 14.89% intra-abdominal abscesses, at 4.25% colic necrosis and 2.12% tumour block by tumour invasion. The practice of a stoma was associated with the presence of intraoperative complications ( $p < 0.05$ ) or diastatic perforation ( $p < 0.05$ ). 85 patients (18.51%) enrolled in the study group had the invasion of neighbouring organs, 97 patients (21.60%) had metastases. The internal stoma or internal derivations were associated with the presence of invasion in other organs ( $p < 0.05$ ) and with the presence of intraperitoneal metastases ( $p < 0.05$ ) (*Table 1*).

The average length of hospital stay was 15 days, 224 patients (49.9%) stayed in the hospital for less than 15 days, while 225 (50.1%) stayed 15 days or more. Hospitalization of fewer than 15 days was associated with the practice of a stoma with or without resection, and more than 15 days with the practice of resection with anastomosis ( $p < 0.05$ ) (*Table 1*).

## Discussions

The surgeries performed on the patients in the group were: external derivations (operation 1) - 16.26%, internal derivations (operation 3) - 9.13%, resections followed by colostomy (operation 2) - 37.63% and resections with anastomosis (operation 4) - 36.97%. A study

conducted on patients with complicated colonic tumours and published in 2019, shows that the surgeries performed were stoma - 8.8%, Hartmann surgery - 35.3%, right hemicolectomy and extended right hemicolectomy - 14.7% and 16, respectively. 2%, left hemicolectomy - 7.3%, sigmoid and rectosigmoid resection with anastomosis - 4.4% and 5.9%, respectively, subtotal colectomy with anastomosis - 4.4%, subtotal colectomy with a terminal ileostomy - 2.9%. We appreciate that the results are comparative, both studies being performed in emergency hospitals (10).

Statistical analysis of our study showed that external derivations (continuous colostomies, Pezzer cecostomies) were correlated with preoperative clinical features such as old age, affected general condition, the onset of the disease for 6-14 days, the existence of abdominal pain and the presence of cachexia. Regarding the paraclinical elements, the external derivations were correlated with the presence of hydroaerial levels on simple abdominal radiographies. Among the intraoperative findings, statistical correlations were made with tumours of the rectosigmoid junction, with the imminence of diastatic perforation, with invasion in neighbouring organs and with the presence of metastases. These patients had a hospital stay of fewer than 15 days. Practically, the usefulness of external derivations is maximum in elderly patients, with an altered general condition, with an obvious diagnosis of occlusion, with tumours at the rectosigmoid junction, as well as in patients with tumour invasion in neighbouring organs or patients with distant metastases. We are talking about such patients in whom the operating time must be shortened or in whom the tumour cannot be resected.

Constantin et al. in a study published in 2020 on emergency surgery for complicated colorectal cancer find, like us, that colostomy has been associated with old age, neglected symptoms, cachexia, complicated tumours with imminent diastatic perforation and with advanced stages of the disease. In addition to our data, the authors also found statistically significant correlations between a colostomy

and rural areas, associated diseases, especially atrial fibrillation, oliguria, anaemia and hydro electrolytic disorders on admission, tumours complicated by haemorrhage and well or medium differentiated tumours (11,12).

Regarding the reasons for hospitalization, most patients had abdominal pain (96.65%), nausea (88.41%) and absence of intestinal transit (73.71%). A study conducted in 2007 on a group of 150 patients with intestinal occlusion by colon tumours showed that the absence of intestinal transit was 80-90%, while abdominal meteorism occurred at 65,3% of patients (13). The differences are because the current group were included patients with perforations and haemorrhages, not only with occlusions.

From a statistical point of view, we found that colonic resections followed by stoma were associated with colonic perforations; cases operated most often in the first 12 hours after hospitalization. In a full peritoneal process, anastomoses are risky, the choice of a colostomy being the preferred option. At the same time, the colostomy shortens the operative time, which is preferred in a patient who is often septic, without an optimal preoperative preparation. The location of choice for these interventions was the sigmoid and the rectosigmoid junction (14,15).

A similar study shows that Hartmann's operations were associated with the significant hereditary-collateral history, neglected symptoms, intestinal transit disorders and abdominal pain on admission, leukocytosis, intestinal perforation, sigmoid tumours and recto-sigmoid junction and stage II TNM. We also reported a static association between colostomy resections and tumour location at the sigmoid or rectosigmoid junction (12).

The statistical analysis performed showed that the internal derivations (practised in a percentage of 9.13%) were correlated with the intestinal occlusions. From the point of view of tumour location, the internal derivations correlate with the tumours of the cecum and tumours of the ascending colon for which a side-to-side ileocoloanastomosis was performed. They have also been performed in

patients who had the invasion of neighbouring organs, the tumours being unresectable, or distant metastases. There is also the possibility of multiple organ resections when tumours invade the surrounding structures. In our group, this option was not chosen. Internal bypass is a quick, technically simple procedure with few postoperative surgical complications, which is desirable in emergency surgery. Other data in the literature show that internal derivations are less used - a study conducted in France shows that only 0.1% of patients with occlusions have benefited from this type of intervention (16).

Like us, Constantin et al. report that internal derivations have been associated with the presence of intestinal obstruction at admission, liver metastases and invasion of neighbouring organs. Unlike us, who found correlations between internal derivations and tumour locations at the cecum and ascending level, Constantin reports correlations with splenic or descending colon tumours and stage IV of the disease (12). 21.6% of patients included in the study group had metastases detected intraoperatively. Tebala et al. estimates in a group of 131 cases that 34.4% of patients admitted to the emergency department have metastases (8).

66% of the patients included in the study group had anaemia. Ristescu et al., in a study related to anaemia and perioperative transfusion in colorectal cancer, show that 13.1% of patients diagnosed with colon cancer had mild anaemia preoperatively, 39% - moderate and only 10.5% severe anaemia. Thus, 62.6% of patients presented with different degrees of anaemia, results similar to those obtained by us. Postoperatively, mild anaemia amounts to 14.6%, moderate anaemia to 60.2%, and severe anaemia remains at 10.5%. The transfusion rate was reported at 27.6% (17).

Some authors believe that resection with anastomosis can be performed even in an emergency, even for patients with peritonitis. Of course, the primary anastomosis in the process of peritonitis requires drastic safety measures to prevent the appearance of fistula: precise position of the anastomosed heads,

supple colic heads, well-vascularized, non-friable, without tension in the anastomosis, but if all these conditions are met, the risk of the fistula is minimal (18).

In the case of occlusions, one can choose between serial interventions and treatment in a single operative time, with primary anastomosis; the latter finding more and more followers. They believe that there is a quasi-normal amount of collagen in the occlusive colon, which translates into its unaltered ability to heal and increased blood flow also contributes to the safety of the anastomosis (19-23).

Pisano in the WSES (World Society of Emergency Surgery) guide recommend in patients with right occlusive tumours of the colon right hemicolectomy with protective ileostomy and a simple ileostomy for unstable patients. In these cases, we performed the right hemicolectomies or internal derivations. For perforated tumours of the colon it is recommended a right hemicolectomy with ileostomy, an aspect noticed in our group of patients. For occlusive tumours of the left colon, Hartmann's surgery should be first-line; unstable patients can benefit from a continuous colostomy on the transverse, aspect also noticed by us. For perforated tumours of the left colon, Hartmann's surgery remains the ideal solution. We also performed Hartmann surgery on these patients. For perforated tumours of both the right colon and the left colon, Pisano also considers the open abdomen for scheduled reoperations (9).

## Conclusions

1. We obtained statistically significant results in correlating colostomies with the advanced age of patients, presence of abdominal pain, cachexia and absence of intestinal transit at admission, with the onset of symptoms of about 6-14 days, in patients with the affected general condition (ECOG 3), in those with hydroaerial levels on abdominal radiographies, in patients with tumour location at the rectosigmoid junction, with intraoperative aspects such as imminent

- diastatic perforation, tumour invasion in neighbouring organs or distant metastases.
- Resections with stomas were associated with the preoperative diagnosis of digestive perforation, with the surgical intervention performed in the first 12 hours and with sigmoid or recto-sigmoid junction tumours.
  - Internal derivations were associated with the presence of nausea and vomiting at admission, the onset of symptoms for about 2-5 days, preoperative diagnosis of intestinal occlusion, tumour location at the cecum or ascending colon level and intraoperative aspects suggestive of tumour invasion in the neighbouring organs or the presence of distant metastases.
  - Resections with anastomosis per primam were associated with age less than 68 years, the onset of symptoms greater than 14 days, patients with the good or satisfactory general condition (ECOG 0 and ECOG 1), anaemic patients, radiological aspects without suggestive changes for the diagnosis of intestinal occlusion or perforation of the digestive tract, those with a preoperative diagnosis of IDH, interventions performed more than 24 hours after admission, those with tumours located in the transverse colon.

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The authors declare no conflicts of interests and no funding source in this study.

### *Ethics Approval*

Local ethical agreement were obtain from Clinical Emergency County Hospital “Sf. Ap. Andrei”, Galati, Romania.

### *Author's Contributions*

All authors contributed equally to the manuscript.

### **References**

1. Ferlay J, Soerjomataram I, Diskshit R, Eser S, Mathers C, Rebelo M et al.

2. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. *Int J Cancer* 2015;136(5),E359-386.
3. Yang XF, Pan K. Diagnosis and management of acute complications in patients with colon cancer: bleeding, obstruction, and perforation. *Chin J Cancer Res.* 2014;26(3):331-340.
4. Ionescu G. *Chirurgia colonului*. Cluj-Napoca: Ed. Dacia; 1984. p. 321-350.
5. Beuran M, Grigorescu M, Pascu O. Actualitati in patologia colonului. Cluj-Napoca: Ed. Medicala Universitara "Iuliu Hatieganu"; 2007. p. 9-141.
6. Lee-Kong S, Lisle D. Surgical Management of Complicated Colon Cancer. *Clin Colon Rectal Surg.* 2015;28(4):228-233.
7. Jinescu G, Murgu C, Ene B, Andrei S, Lica I, Beuran M. Cancerul colonic perforat. Simpozionul Patologia Colonului – Cluj Napoca, 11-13 mai 2006
8. Bertolotto E, Di Brita N. Tumori multipli del colon. *G Chir.* 2006;27(8/9): 305-310.
9. Tebala GD, Natili A, Gallucci A, Brachini G, Khan AQ, Tebala D, et al. Emergency treatment of complicated colorectal cancer. *Cancer Manag Res.* 2018;10:827-838.
10. Pisano M, Zorcolo L, Merli C, Cimbanassi S, Poiasina E, Ceresoli M, et al. 2017 WSES guidelines on colon and rectal cancer emergencies: obstruction and perforation. *World J Emerg Surg.* 2018;13-36.
11. Enciu O, Calu V, Angelescu M, Nădrăgea MA, Miron A. Emergency Surgery and Oncologic Resection for Complicated Colon Cancer: What Can We Expect? A Medium P Volume Experience in Romania. *Chirurgia (Bucur).* 2019; 114(2):200-206.
12. Doran H, Pătrașcu T, Catrina E, Mihalache O. Hartmann 's procedure. A 30 years one-centre clinical experience. *Chirurgia (Bucur).* 2008;103(4): 413-416.
13. Constantin BG, Firescu D, Voicu D, Ștefănescu B, Mihailov R, Șerban C, et al. Emergency surgery for complicated colorectal cancer – What we choose: a retrospective cohort study. *Romanian Journal of Military Medicine.* 2020;CXXIII(4):258-266.
14. Markogiannakis H, Messaris E, Dardamanis D, Pararas N, Tzertzelis D, Giannopoulos P, et al. Acute mechanical bowel obstruction: clinical presentation, etiology, management and outcome. *World J Gastroenterol.* 2007; 13(3):432-437.
15. Medina Villaseñor E, Quezada Adame I, Martínez Macías R, ElviaNeyra Ortiz, Parra PAO, Cruz MR. Urgenciasgastrointestinales en el paciente con cancer. *Acta Médica Grupo Angeles.* 2011;9(3):136-142.
16. Lopez J, Mariangel P, Cardenas N, Jahnsen J, Massri D, Werner A, et al. Cancer colorectal complicado. *Cuad. Cir.* 2004;18:11-20.
17. Manceau G, Mege D, Bridoux V, Lakkisv Z, Venara A, Voron T, et al. Emergency Surgery for Obstructive Colon Cancer in Elderly Patients: Results of a Multicentric Cohort of the French National Surgical Association, *Dis Colon Rectum.* 2019;62:941-951.
18. Ristescu I, Pintilie G, Filip D, Jitca M, Fechetă R, Florescu I, et al. Perioperative Anemia and Transfusion in Colorectal Cancer Patients. *Chirurgia (Bucur).* 2019;114(2):234-242.
19. Nicholls RJ, Dozois R. *Surgery of the colonul and rectum*. New York: Churchill Livingstone; 1997. p. 1-53.
20. Valerio D, Jones PF. Immediate resection in the treatment of large bowel emergencies. *Br J Surg.* 1978; 65:712-716.
21. De Salvo GL, Gava C, Pucciarelli S, Lise M. Curative surgery for obstruction from primary left colorectal carcinoma: primary or staged resection? *Cochrane Database Syst Rev* 2004;(2):CD002101.
22. Hendriks T, Mastboom WJ. Healing of experimental intestinal anastomoses. Parameters for repair. *Diseases of Colon & Rectum.* 1990;33(10):891-901.
23. Zastavitsky Gh, Ghidirim Gh, Mishin I. Collagen variation in left-sided colonic obstruction: experimental study in rats. *World J Surg.* 2009; 33(1): 37-38.
24. Papanicolaou G, Ahn YK, Nikas DJ, Fielding LP. Effect of large-bowel obstruction on colonic blood flow. An experimental study. *Dis Colon Rectum* 1989;32(8):673-9.