

# Surgical Management of Perforated Colon Tumours in Yaoundé: A Multicentre Retrospective Review of 30-Day Postoperative Outcome

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## Abstract

**Introduction:** Colon cancer is often diagnosed late in our context and there is a high prevalence of complicated forms, this including perforation. The optimal surgical treatment remains controversial. The aim of this study was to improve the short-term postoperative outcomes of patients operated upon for perforated colon cancer, by identifying factors associated with complications occurring within 30 days after surgery. **Patients and methods:** We carried out an analytical observational study, with a retrospective collection of data from the files of patients operated upon for an *in situ* tumoral colon perforation. This was done in four referral hospitals in the city of Yaoundé. The period was from the 1<sup>st</sup> of January, 2012 to the 31<sup>st</sup> of December, 2021. Cox regression identified the factors associated with postoperative morbidity and mortality. **Results:** We collected files of 46 patients. The mean age was  $54.7 \pm 19.9$  years with a sex ratio of 1.4. The clinical presentation on admission was dominated by the presence of signs of peritoneal irritation (91.3%) and bowel obstruction (28.3%). The diagnosis was made preoperatively in 16 cases (34.8%). The surgical procedures consisted of colectomy with anastomosis in 28 cases (60.9%) and without anastomosis in 14 cases (30.4%). Postoperative morbidity was 60.9% dominated by surgical site infection (37%). Postoperative mortality was 39.1%. The existence of generalized peritonitis was asso-

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ciated with the occurrence of postoperative complications ( $p = 0.019$ ). The main factors associated with postoperative mortality were resection with primary anastomosis ( $p = 0.027$ ), enterocutaneous fistula ( $p = 0.005$ ). **Conclusion:** Colic resection with primary anastomosis or ideal colectomy is associated with an increased risk of mortality and should therefore not be performed in this setting.

### Keywords

Perforated Colon Cancer, Postoperative Morbidity and Mortality, Colectomy, Acute Generalized Peritonitis

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## 1. Introduction

Colorectal cancer is a public health concern worldwide. Like other digestive tumors it is characterized in our country by a delay in diagnosis and at often advanced stages, consequently a high prevalence of complicated forms [1] [2] [3] [4] [5]. Usually, in more than 20% to 30% of cases, there are acute symptoms or complications requiring emergency surgery in patients who are often elderly, with numerous comorbidities and in precarious physiologic states [6] [7] [8]. While tumor obstruction is the most frequent complication [6] [7] [9] [10] [11] [12], perforation exposes patients to a potential life-threatening double condition: the underlying tumor pathology and the related consequences of sepsis with peritonitis. Perforation can occur proximal to the tumor in case of colon distension secondary to tumor obstruction or at the tumor site due to tumor necrosis [13]. The first situation seems more severe, when the perforation is due to bowel distension and generally a diffuse fecal peritoneal contamination leading to septic shock. In the second situation, the contamination is generally localized, with often a purulent collection, having a low risk of severe peritonitis [13]. Postoperative morbidity and mortality in both cases are very high [6] [7] [14].

In other complications, alternatives to emergency colon resection exist, particularly a diversion stoma or stents in cases of obstructions caused by tumor and blood transfusion in the event of bleeding, but emergency surgery is very often the rule in case of perforation [7]. Colon resection in this context is very difficult, the surgeon having to deal with a certain number of unfavorable situations: septic shock which requires limited gestures in a very short time, the difficulty of defining the right tissue cleavage planes and the strong technical request for oncological resection without a satisfactory prior preoperative oncological evaluation [14]. These technical difficulties certainly attest to the high prevalence of complications with high postoperative mortality [6] [7] [9] [10] [14] [15] [16] and often poorer late oncological outcomes [11] [15] [16] [17] [18] [19] [20] [21]. However, some authors [9] [10] [14] have reported overall survival or disease-free survival rates identical to those of patients managed electively. Oncologic resection in this context should therefore be preferred when-

ever local conditions permit [6] [9] [10] [16].

In Cameroon, colorectal cancer is frequent, representing the second digestive cancer after liver cancer [5] and the first digestive cancer most often operated [22]. Advanced and complicated forms are frequent [1] [12] [22]. Despite these figures, no study had yet been conducted on the surgical treatment of perforated colon tumors. The aim of this work was to describe the different surgical modalities used to manage perforated colon cancer, to evaluate the postoperative morbidity and mortality and to define the associated factors.

## 2. Patients and Methods

We conducted a multicentre analytical cross-sectional study in four hospitals in Yaoundé, the capital city of Cameroon: the Yaoundé University Teaching Hospital, the Yaoundé General Hospital, the Yaoundé Emergency Center and the Yaoundé Central Hospital. These are first and second category hospitals of the national health pyramid and university hospitals comprising both emergency units, general and digestive surgeons with ability in treating surgical abdominal emergencies.

We reviewed the operative and hospitalization's reports of these hospitals to identify all the patients operated on for perforated colon tumor for a 10-year period spanning from 1<sup>st</sup> of January 2012 to 31<sup>st</sup> of December 2021. The files of patients of both sexes over 15 years old were retained. Socio-demographic, clinical, paraclinical, therapeutic and evolutionary data of the patients were collected. The results of the operation should be known within 30 days following surgery. Incomplete files and files of patients lost to follow up before the postoperative day 30<sup>th</sup> were excluded.

All data were analysed with IBM SPSS® (SPSS Inc., version 23, Chicago, IL, USA) and Microsoft Excel 2016. Counts and percentages were determined for categorical variables and means and standard deviations (mean  $\pm$  SD) calculated for the continuous variables. Risk factors of morbidity and mortality were grouped and statistical difference between groups was analysed using Fisher's test. Logistic regression analysis was applied on the statistically significant variables in the test and factors affecting morbidity and mortality determined. The statistical significance for these tests was set at  $p < 0.05$ .

## Ethical Considerations

The present study was approved by the institutional ethical clearance committee of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I under the n° 370/UYYI/FMSB/VDRC/DAASR/CSD of June 3, 2022.

All authorizations were obtained from the managers of the different sites selected for the study.

## 3. Results

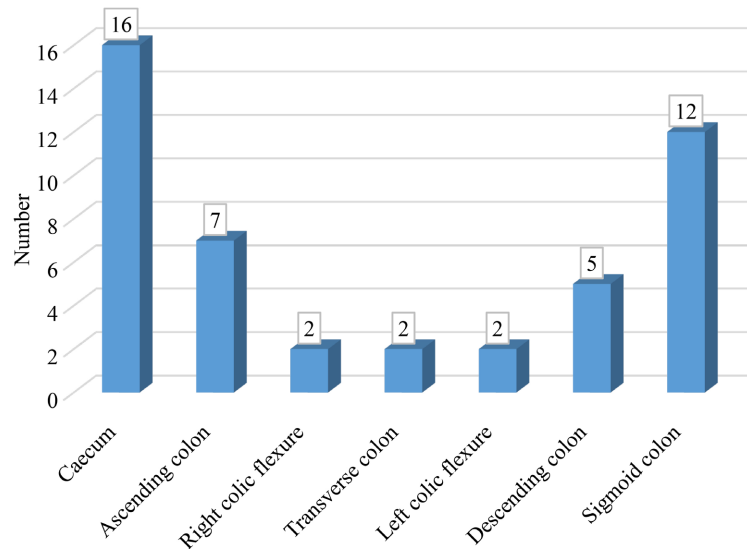
During the study period, 54 patients were operated on for a colon tumour per-

foration. Eight files (14.8%) were excluded. We thus collected 46 patients' files. There were 27 men (58.7%) and 19 women (41.3%) for a sex ratio of 1.4. The ages ranged from 17 to 92 years with a mean age of  $54.7 \pm 19.9$  years. The modal age was 67 years. Twenty-seven patients (58.7%) were above 60 years old. Comorbidities were found in 13 patients (28.3%). On admission, signs of peritoneal irritation were the most common clinical signs, found in 42 patients (91.3%). The diagnosis of colon tumour perforation was made preoperatively with CT scan in 16 patients (34.8%). Clinical epidemiology of our study population is summarized in **Table 1**.

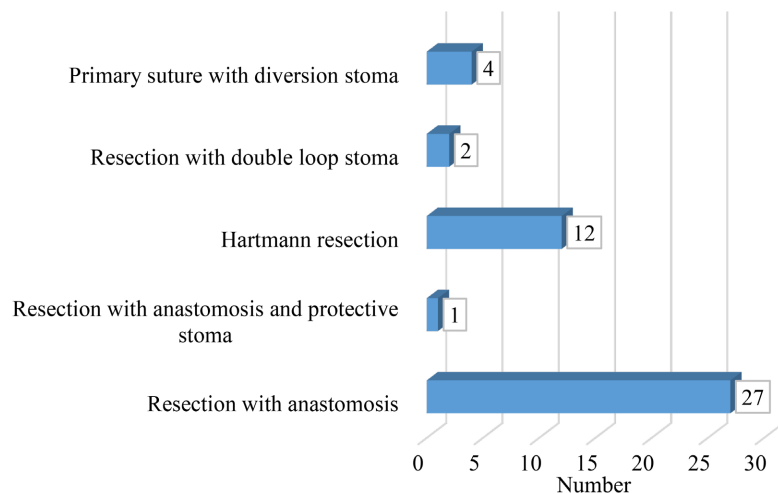
All the patients were operated under general anaesthesia. Twenty-nine (29) patients (63%) had a generalized peritonitis while a localized peritonitis was found in 16 patients (34.8%). One (1) (2.2%) patient had hemoperitoneum as intra-operative findings. The perforation was located at the right colon in 27 cases (58.7%) and in 19 cases (41.3%) at the left colon. The caecum was involved in 16 cases (34.8%). **Figure 1** displays the tumor location. We realized a resection of bowel including the tumor with anastomosis in 28 patients (60.9%). This anastomosis was protected by a stoma in one patient. This attitude was same in all our patients who had a right colon tumor perforation. In 14 patients (30.4%), resection without anastomosis was performed. This was a Hartmann's procedure in 12 patients (26.1%) and a double loop stoma using Bouilly Volkmann's technique was used in two (2) patients (4.3%). In the remaining four (4) patients (8.7%), intra-operative difficulties hindered mobilization of the colon. A suture of the perforation with epiploplasty and bypass stoma was performed. All the gestures performed are resumed in **Figure 2**.

**Table 1.** Clinical epidemiology of the study population.

Variables	Number	Percentage
<b>Sex</b>		
Male	27	58.7
Female	19	41.3
<b>Age</b>		
<60	19	41.3
>60	27	58.7
<b>Comorbidities</b>		
Diabetes	4	8.7
Hypertension	6	13
HIV	1	2.2
Chemotherapy	4	8.7
<b>Clinical presentation at admission</b>		
Signs of peritoneal irritation	42	91.3
Signs of intestinal occlusion	13	28.3
Lower gastro-intestinal bleeding	3	6.5

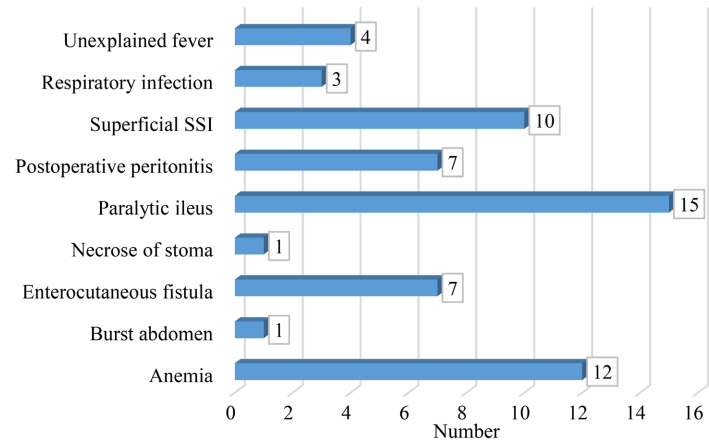


**Figure 1.** Site of perforation.



**Figure 2.** Gestures performed.

Of all the 46 patients, 28 presented with at least one complication within the month following the surgery, giving a 30 days morbidity rate of 60.9%. Paralytic Ileus was the main complication, reported in 15 patients (32.6%). **Figure 3** resumes complication distribution in the study population. More of Grade I complications, recording 41.3% of all the complications, were observed (**Figure 4**). Generalized peritonitis was the only variable associated with post-operative complications (**Table 2**). Eighteen patients died, giving a 30 days mortality rate of 39.1%. The causes of mortality were a septic shock in 7 patients, multi organ failure in 5 cases and pulmonary embolism in one patient. In five patients, no cause of death was specified. The factors associated with post-operative mortality were resection and primary anastomosis, generalized peritonitis with primary resection and anastomosis, and Clavien Dindo grade IVa complications (**Table 3**).



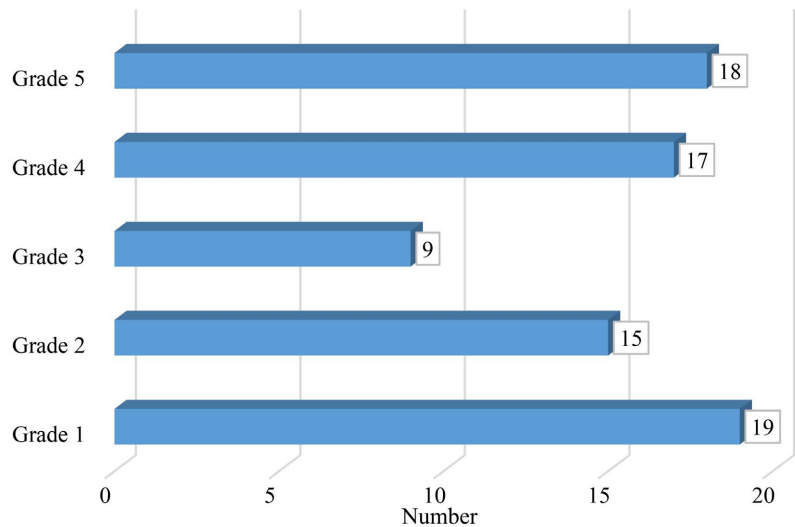
**Figure 3.** Postoperative complications.

**Table 2.** Factors Associated to postoperative complications.

Variables	OR	95% CI	p-value
Generalized peritonitis	7.467	(1.39 - 40.25)	<b>0.019*</b>
Intra operative diagnosis of colon cancer perforation	0.19	(0.04 - 0.95)	0.052
Resection and primary anastomosis	3.033	(0.68 - 13.61)	0.137
Right colon perforation	2.167	(0.49 - 9.6)	0.258

**Table 3.** Factors associated to mortality.

Variables	OR	95% CI	p-value
Gender	1.02	(0.24 - 4.4)	0.638
Generalized peritonitis	3.636	(0.62 - 2.13)	0.14
Intra operative diagnosis of colon cancer perforation	0.46	(0.09 - 2.25)	0.282
Right colon perforation	5.56	(0.95 - 32.46)	0.05
Resection and primary anastomosis	6.875	(1.17 - 40.37)	<b>0.027*</b>
Generalized peritonitis with primary anastomosis	5.54	(1.37 - 22.37)	<b>0.007*</b>
Surgical site infection	0.77	(0.06 - 9.58)	0.241
Burst Abdomen	2.67	(0.48 - 14.9)	0.613
Paralytic Ileus	2	(0.43 - 9.29)	0.308
Re-Laparotomy	1.08	(0.15 - 7.64)	0.651
Grade I complication	3.03	(0.68 - 13.61)	0.137
Grade II complication	3.75	(0.77 - 18.21)	0.1
Grade IIIb complication	0.75	(0.12 - 4.9)	0.174
Grade IVa complication	0.58	(0.36 - 0.94)	<b>0.005*</b>
Grade IVb complication	4.25	(0.64 - 28.25)	0.137



**Figure 4.** Grading of complications using the CLAVIEN-DINDO scale.

#### 4. Discussion

Following literature, 20% to 30% of colon cancers will require emergency surgery, most often for an obstruction or perforation [6] [7] [8]. Colon perforation, which is less frequent, nevertheless exposes the patient to a risk of severe peritonitis [13]. These patients often present with an unstable hemodynamic state and significant contamination of the surgical field. Tissue planes are poorly defined with more or less significant edema of the bowels and mesenteries. Moreover, these patients often have a higher tumor staging and ASA score than patients without a perforation [14] [23]. An exhaustive preoperative staging assessment is usually impossible. These conditions reflect the frequent operative difficulties in these cases, resulting in often suboptimal tumor resection [14]. The hemodynamic instability and the significant peritoneal contamination attest to the high perioperative morbidity and mortality. The early and aggressive control of these make it possible to reduce morbidity and mortality, thus must be the first goal of treatment [7] [14]. Sub-optimal tumor resection with fewer lymph nodes removed and a lower rate of R0 resection would explain the high rate of recurrence and the significant decrease in overall survival in these patients, compared to patients operated upon without any complication [14] [16] [24]. However, perioperative mortality is considered by several authors to be the main reason for the reduction in overall survival in cases of colon tumor perforation [14]. Thus, when peri-operative deaths are excluded from survival evaluations, the survival curve of these patients is fairly superimposable on those of other patients [10] [11] [14]. An oncological resection must therefore be performed whenever the hemodynamic state and the local conditions permit [6] [9] [10] [14] [16].

Contrary to obstructions by colon tumors, where a proximal colostomy or the placement of a stent can make it possible to postpone a resection, colon perforation generally requires urgent curative or palliative tumor resection [7]. This could be achieved in 91.3% of cases in this series. In the other cases, the surgical

difficulties mentioned above did not allow tumor resection. In a study published by Ramos *et al.* in 2017 [23], resection was done in 89% of cases of complicated colon cancer. Runkel *et al.* [25] reported a resection rate of 77% for colon cancers operated as emergencies versus 85% for those operated electively. The surgical strategy in tumoral colon perforations remains controversial, the therapeutic modalities depending on the general condition of the patient, the experience of the surgeon and the quality of the technical platform. Traditionally, a multi-step surgical strategy has long been advocated for. However, it raises the question of restoring bowel continuity in these often elderly and fragile patients. Emergency resection followed by transverse ileocolic anastomosis is generally accepted for perforated right colon cancer [10] [26] [27] [28] [29]. This attitude was adopted for all the patients with right colon tumor perforations in this series. Resection without anastomosis is recommended in left colon perforations [10] [26]. Fifteen of the perforated left colon cancers in this series were resected. A Hartmann procedure was carried out in 26.1% of cases, a resection with double loop stoma in 4.3% of cases and a resection with anastomosis in one case. In the study carried out by Runkel *et al.* [25], 90% of their patients with perforated colon cancers underwent a resection; a primary anastomosis was performed in 66.7% of proximal colon resections and only in 22.2% of distal colon resections, while a Hartmann procedure was done in 77.8% of cases.

The complication rate after resection of perforated colon cancer is very high, reaching 60% in some studies [7] [9] [14] [15] [16] [25]. In this study, postoperative morbidity was 60.9%. Though high, it remains close to that of other authors. Acute generalized peritonitis was associated with the occurrence of complications in our study. In a study published in 2011 by Zielinski *et al.* [14], a higher proportion of postoperative complications was found in case of free colonic tumor perforation responsible for generalized peritonitis (66%) compared to concealed perforation (46%). These results had been found earlier by Runkel *et al.* [25] who reported a complication rate of 50% in patients with localized peritonitis, 75% in cases of generalized peritonitis and in all cases of fecal peritonitis. Infectious complications, including anastomotic leaks, were frequent. Peritoneal contamination has long been a contraindication to primary anastomosis [30] [31]. In the study carried out by Runkel *et al.* [25], an anastomosis was done in 50% of patients with localized peritonitis and only 13% of cases who had a generalized peritonitis, with none in case of significant fecal contamination. Currently, peritoneal contamination alone is no longer a contraindication to performing an anastomosis, other factors must be taken into consideration [13] [32] [33] [34].

The postoperative mortality of 39.1% found in this study was slightly higher than the 30% reported by Runkel *et al.* in 1991 [25]. On the other hand, it was very high compared to that of many authors [7] [9] [14] [16]. A recent Danish series of 6147 patients reported a postoperative mortality of 16% [35]. In all cases, postoperative mortality is higher in patients with colon tumor perforation or in case of complications [7] [14] [16]. Emergency colon tumor resection is an



independent mortality factor found by some authors [7]. Other factors such as advanced age, a high ASA score, a high Charlson score, transverse or right colonic resections, terminal ileostomy have also been reported [7]. The factors associated with postoperative mortality in this study were resection with primary anastomosis, performing an anastomosis in the presence of generalized peritonitis, and Clavien Dindo grade IVa complications. The severity of sepsis is associated with postoperative mortality in these patients [16] [25]. Anastomotic leaks are an independent factor of postoperative mortality as reported by Bakker *et al.* in 2016 [7], who found a postoperative mortality of 13.5% in case of an anastomotic leaks compared to 3.7% of deaths in their absence.

This study presents some limitations mainly linked to its sampling. The retrospective collection of data with the related shortcomings and the small size of the sample do not allow us to overgeneralize the results. However, the multicenter nature of this study is a strength. A larger series extended to other hospitals and regions of the country will be necessary to validate these results.

## 5. Conclusion

Emergency colon surgery for *in situ* tumor perforation is associated with significant morbidity and high mortality in Yaoundé, particularly in patients with acute generalized peritonitis. Resection-anastomosis or ideal colectomy is the most often performed surgical procedure. However, it is associated with an increased risk of death and should therefore not be performed in this situation. Anastomotic leak is an independent factor of postoperative mortality. Improving these results requires rapid management of patients with colon cancer once the diagnosis has been made.

## Conflicts of Interest

The author declares no conflicts of interest regarding the publication of this paper.

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