

Obstruction and Perforation in Colo-Rectal Cancer

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CARCINOMA of the colon and rectum continues to be the leading cause of death from neoplastic disease in the United States. Previous reports by the authors^{7, 11} have described the scope of this problem, its surgical management and results of therapy in a large series of patients. At the present time, approximately 20 per cent of patients with colo-rectal cancer develop bowel obstruction and/or perforation late in the course of the disease. Review of the available literature on this subject attests to the high operative mortality and low 5-year survival rates associated with these complications. The diagnosis and treatment of these patients pose problems that are peculiar both with respect to the disease itself as well as the supervening complications. A review of 33 years' experience in the management of patients with obstruction and/or perforation of the colon due to carcinoma at The New York Hospital-Cornell Medical Center is reported.

Clinical Material

The records of 1,815 patients with carcinoma of the colon and rectum who were admitted to the pavilion service of The New York Hospital-Cornell Medical Center from September 1, 1932 through December 31, 1965 were reviewed. Of this group, 210 patients (11.6%) had complete obstructions, 99 patients (5.5%) perforation, and 30 patients (1.7%) both obstruction and perforation of the large bowel (Fig. 1). With the exception of two pa-

tients who refused operation, a histologic diagnosis was obtained in each individual. Patients who had received prior definitive therapy elsewhere or in whom a histologic diagnosis was not established were excluded. Operative notes, surgical pathology reports and x-ray interpretations were employed to define the location of the colonic neoplasms. For carcinomas of the rectum and rectosigmoid, the location of the neoplasm was determined by proctoscopic examination. The information from each patient's hospital record was abstracted and transferred to data processing cards. Data analysis was performed by an IBM 1401 computer.

Carcinoma of the Colon and Rectum with Obstruction

Two hundred ten patients (11.6%) had complete obstructions of the large bowel due to carcinoma. The diagnosis of complete obstruction was based upon an evaluation of the clinical, radiologic and pathologic data available in the patient's hospital record. Patients with incomplete obstruction were excluded from the study because of the difficulty in correlating the extent of constriction of the bowel lumen with the surgical management employed and the eventual success or failure of therapy.

The sex distribution of the patients with obstruction was evenly divided between male (105) and female (105). There were 203 Caucasians and seven Negroes. The patients ranged in age from 27 years to 88 years with a median of 62 years.

The location of the malignant lesions which produced complete obstruction of

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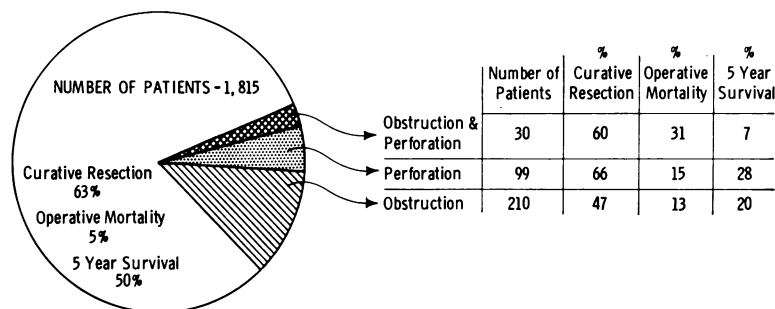


FIG. 1. Three hundred thirty-nine of 1,815 patients with carcinoma of the colon and/or rectum who had obstructions, perforations, or both.

the colon is depicted in Figure 2. Almost three fourths (74.8%) of the carcinomas were located in the distal segments of the colon and rectum. There were 29 patients (13.8%) with lesions in the right colon including the hepatic flexure and 24 patients (11.4%) with carcinoma of the transverse colon and splenic flexure.

There was one patient who was asymptomatic and another who had had symptoms of 5 years' duration. A majority of the patients (118 or 56.2%) had symptoms for less than 3 months. Another 34 patients (16.2%) had symptoms for 3 to 6 months. Thirty-five patients (16.7%) had symptoms for more than 6 but less than 12 months. There were 18 patients (8.6%) with symptoms for 1 to 2 years and five patients (2.4%) who had had symptoms for more than 2 years. The median duration of symptoms for the entire group was 3 months. The symptoms most frequently acknowledged were abdominal pain (176 patients or 83.8%) and change in bowel habits (175 patients or 83.3%), the latter usually characterized as progressive obstipation. Weight loss was noted by 109 patients (51.9%), abdominal distension by 82 patients (39.0%) and rectal bleeding by 68 (32.4%).

Abdominal distension was the most frequent physical finding and was noted in 111 patients (52.9%). A palpable mass was present in 101 patients (48.1%). The mass was palpated by rectal examination in 51 patients (24.3%) and by abdominal examination in 50 patients (23.8%). Hepatomegaly was present in 20 patients (9.5%).

Laboratory data disclosed an anemia, i.e., a hemoglobin of less than 11 Gm. or a hematocrit of less than 35% in 29 patients (13.8%). Stool examination for occult blood was performed in 204 (97.1%) of the patients and was positive in 88 (43.1%). Proctoscopy was performed in 139 patients (66.2%) and of these, carcinoma was visualized in 71 patients (51.1%). Barium roentgenograms of the colon were obtained in 161 patients (76.7%) and were positive in 71 (44.1%).

The clinical status, that is the extent of the disease present on admission to the hospital, was determined by analysis of the therapy employed. Three patients with far-advanced disease were considered inoperable and died before treatment was instituted. Another three patients refused op-

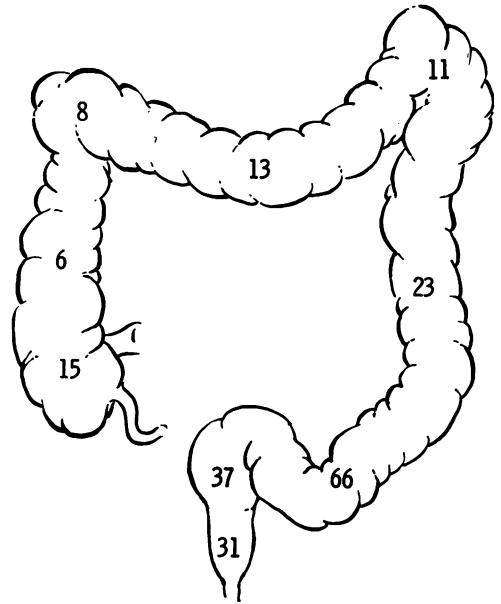
TABLE 1. *Surgical Operations in 204 Patients with Obstructing Carcinoma of the Colon and Rectum*

Palliative	106
Colostomy	73
Segmental resection of colon	21
Ileotransverse colostomy	6
Exploratory laparotomy and biopsy	6
Curative	98
(A) With preliminary colostomy	67
Transverse colectomy	7
Left colectomy	14
Sigmoid colectomy	38
Abdomino-perineal resection	8
(B) Without preliminary colostomy	31
Right colectomy	15
Transverse colectomy	7
Left colectomy	1
Sigmoid colectomy	5
Abdomino-perineal resection	1
Perineal resection	2

eration. Of the remaining 204 patients with obstructing carcinoma of the colon and rectum, 106 (51.9%) had palliative procedures. In 85 patients (40.5%) the primary carcinoma was unresectable and in 21 (10.3%) a palliative resection of the primary lesion was feasible. The remaining 98 patients (46.7%) had curative operations.

The operations employed are listed in Table 1. It is significant that all curative operations for lesions in the right colon were accomplished without preliminary diversion of the fecal stream. For lesions in the transverse colon, one-half were resected primarily and one-half following preliminary decompression colostomy. In the latter instances, the tumors were located in the region of the splenic flexure. Of the 69 patients who underwent curative resections for carcinoma distal to the splenic flexure, a preliminary transverse colostomy was performed in 60 patients. The remaining nine patients had primary resections without preliminary colostomy. There were 26 postoperative deaths, a mortality rate of 12.7 per cent in the group of 204 patients operated upon. Of the 106 patients who had palliative operations, 18 (17.0%) died. In contrast, there were only eight deaths (8.2%) in the group of 98 patients who had curative procedures.

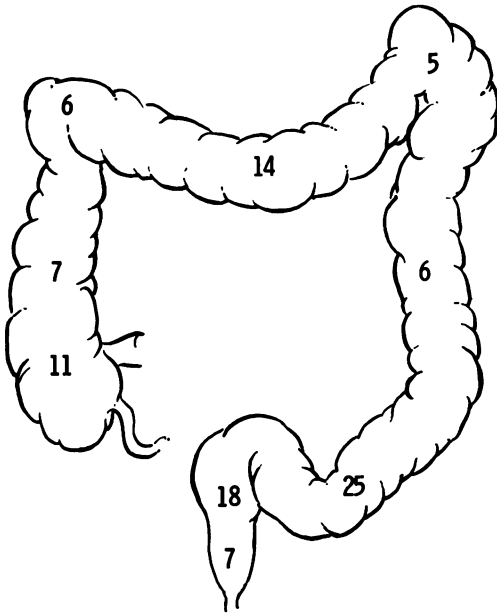
Of the 210 patients admitted to this hospital for primary or definitive treatment of obstructing carcinoma of the colon and rectum, seven (3.3%) were lost to follow-up before 5 years. In calculating 5-year survival rates, these patients were considered to have died of their disease before 5 years had elapsed from the time of operation. The overall 5-year survival rate was 19.5 per cent (41 patients). Three patients (1.4%) who were alive 5 years after operation are known to have recurrent carcinoma. There were no 5-year survivors in the group of patients subjected to palliative operations. The survival rates after curative operations are listed in Figure 2 according to Dukes classification. Of the 28 patients



		5 Year Survival	
Dukes Classification		Number of Patients	Per cent
A	28	16	57.1
B	49	19	38.8
C	21	6	28.6
	98	41	41.8

FIG. 2. Site of obstructing carcinoma in 210 patients with 5-year survival of 98 patients who had curative operations.

with Dukes A lesions, i.e., carcinomas confined to the bowel wall, 16 (57.1%) survived 5 years. Forty-nine patients classified as Dukes B, in whom the carcinoma extended through the bowel wall, had a 5-year survival rate of 38.8 per cent, or 19 patients. Of the 21 patients with Dukes C lesions, i.e., metastases to lymph nodes, there were only six patients (28.6%) who survived 5 years. The mean survival time following a palliative colostomy in patients who were unresectable was 6.1 months. In those patients who had a palliative resection of the primary lesion, the mean survival time was 10.3 months. It would there-



		5 Year Survival	
Dukes Classification		Number of Patients	Per cent
B	46	22	47.8
C	19	6	31.6
	65	28	43.1

FIG. 3. Site of perforating carcinoma in 99 patients with 5-year survival of 65 patients who had curative operations.

fore appear justifiable to attempt palliative resection of the tumor in hopes of improving both the quality of survival as well as its duration.

Carcinoma of the Colon and Rectum with Perforation

In the 33 years encompassed by this study, 99 patients (5.5%) had perforations of the colon due to carcinoma. In 58 patients the perforation was localized. As a rule these patients had few, if any, signs of peritonitis. The remaining 41 patients had free perforations into the peritoneal cavity with a variable degree of inflammatory re-

sponse and containment of the perforation. The physical findings in these patients revealed evidence of peritonitis. Perforation of the colon at the site of origin of the tumor was determined by gross examination of the surgical specimens, barium contrast x-rays and operative notes. Adherence of the tumor bearing segment of colon to adjacent organs or structures was not considered as evidence of perforation unless a fistula or microscopic evidence of tumor invasion could be demonstrated.

There were 51 females and 48 males. Ninety-two patients were Caucasians, six Negro and one Oriental. The youngest patient was 22 years of age and the oldest 88 years. The median age was 61 years.

The location of the carcinomas that caused perforation of the colon and rectum is depicted in Figure 3. Slightly more than half (56.6%) of the patients had carcinoma in the distal large bowel and rectum. There were 24 patients with lesions in the right colon including the hepatic flexure. Nineteen patients had carcinoma of the transverse colon or splenic flexure. It is of interest that the percentage of carcinomas that caused perforation of the right colon was almost twice that of the carcinomas causing obstruction of this same segment of the large bowel.

There was one patient who was asymptomatic and another who had had symptoms for 4 years. The median duration of symptoms for the 99 patients was 5 months. There were 45 patients with symptoms of less than 3 months' duration and 22 patients with symptoms for 3 to 6 months. Twenty patients had symptoms for more than six but less than 12 months. There were 10 patients with symptoms for 1 to 2 years and another two with symptoms longer than 2 years. Abdominal pain was the most frequent complaint and was noted by 81 patients. Seventy patients had noted a change in bowel habits, 63 had weight loss and 38 rectal bleeding. There were 12 who had palpated a mass in their abdomen.

The most frequent finding on physical examination was the presence of a mass. In 55 patients the mass was palpated by examination of the abdomen and in 15 patients the mass was disclosed by rectal palpation. As mentioned previously, 41 patients had evidence of perforation on the basis of significant direct and rebound tenderness. Enlargement of the liver was noted in eight patients.

Review of the laboratory data revealed that 33 patients were anemic. Stool examination for occult blood was performed in 81 patients and was positive in 56 (69.1%). Proctoscopic examination was done in 61 patients and the diagnosis of carcinoma was established by biopsy in 27 (44.3%). Barium enema x-rays were performed in 84 patients and were positive in 80 (95.2%).

The clinical status of these patients on admission to the hospital was such that almost two thirds (65 patients) underwent curative operations and one third (33 patients) had palliative procedures. One patient was considered inoperable and he died shortly after admission. Of the 33 patients who had palliative operations, the tumor was unresectable in 20 (60.6%). In 13 (39.4%) patients, a palliative resection of the primary tumor was possible.

Table 2 lists the surgical procedures performed on the 98 patients operated upon for perforating carcinoma of the colon and rectum. In contrast to patients with obstructing carcinoma in whom a curative resection was possible in less than half, almost two thirds of the patients with perforating carcinoma had curative operations. It is also of interest to note that curative operations without a preliminary colostomy were possible in two thirds (67.7%) of the patients with perforating carcinoma. In those patients with obstruction, curative resection without preliminary colostomy was possible in less than one third (31.6%) of the patients. A curative operation was accomplished in 41 of the 98 patients (41.8%) only by extension of the surgical resection

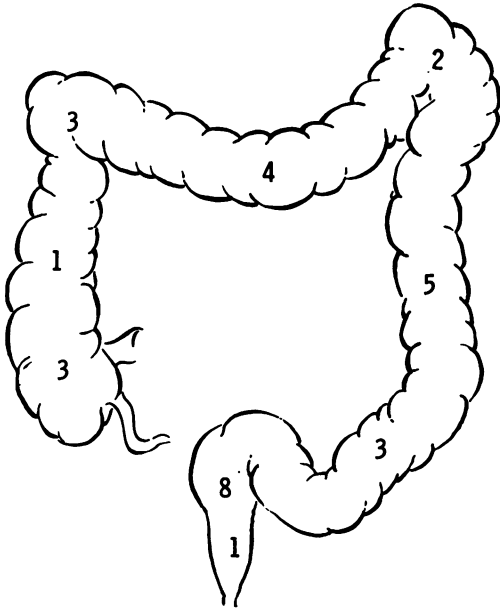
TABLE 2. *Surgical Operations in 98 Patients with Perforating Carcinoma of the Colon*

Palliative	33	
Colostomy	12	
Segmental resection of colon	13	
Ileotransverse colostomy	4	
Exploratory laparotomy and biopsy	4	
Curative	65	
(A) With preliminary colostomy		21
Transverse colectomy	11	
Left colectomy	2	
Sigmoid colectomy	2	
Abdomino-perineal resection	6	
(B) Without preliminary colostomy		44
Right colectomy	18	
Transverse colectomy	5	
Left colectomy	5	
Sigmoid colectomy	8	
Abdomino-perineal	8	

to include adjacent organs. Segmental resection of the small bowel was necessary in 26 patients. In 10 women, all or part of the reproductive organs were removed. Partial cystectomy was performed in nine patients and total cystectomy in one.

The mortality rate following operation in this group of 98 patients with perforating carcinoma was 15.3 per cent, or 15 patients. Of the 65 patients who underwent curative operations, six (9.2%) died. Nine of the 33 patients (27.3%) who had palliative operations died.

Follow-up information was available on all but five of the surviving patients. There were 28 patients in this group of 99 with perforating carcinoma who survived 5 years. Two of the surviving patients alive at 5 years had evidence of recurrent carcinoma. No patients subjected to palliative operations survived 5 years. The survival rates according to the Dukes classification are listed in Figure 3. Since by definition all of these patients had perforating carcinomas, no patients were classified as Dukes A. The 5-year survival rate for the 46 patients with Dukes B lesions was 47.8 per cent. The 19 patients with Dukes C carcinomas had a 5-year survival rate of 31.6 per cent. The 5-year survival rate for the 41 patients with free perforation of the carcinoma into the



Dukes Classification	5 Year Survival	
	Number of Patients	Per cent
A 3	0	0
B 12	2	16.7
C 3	0	0
18	2	11.1

FIG. 4. Site of obstructing and perforating carcinoma in 30 patients with 5-year survival of 18 patients who had curative operations.

peritoneal cavity was 7.3 per cent (three patients). In contrast, the 5-year survival rate for the 58 patients with localized perforations was 41.4 per cent (24 patients). In patients with unresectable carcinoma, the mean survival time after a diverting colostomy was 2.8 months. Patients who had palliative resections of the primary tumor had a mean survival time of 7.1 months.

Carcinoma of the Colon with Obstruction and Perforation

Thirty patients (1.7%) had the dual complications of obstruction and perforation

due to carcinoma of the colon and rectum. In 29 of these patients both the obstruction and the perforation occurred at the location of the carcinoma. One patient with an obstructing tumor of the transverse colon had a perforation of the cecum, presumably the consequence of a competent ileocecal valve.

There were 16 women and 14 men. The age range of these patients was 35 to 88 years, with a median of 62 years. Twenty-four patients were Caucasians and six Negroes.

The site of origin of the carcinomas of the colon and rectum producing both obstruction and perforation is depicted in Figure 4. The distribution of the tumors in these patients was essentially the same as in the patients with perforation alone.

The median duration of symptoms was 2 months with a range of 1 month to 6 years. Nineteen patients (63.3%) had symptoms for less than 3 months and eight (26.7%) had had symptoms for 4 to 6 months. Two patients (6.7%) were symptomatic for 1 year and one for 6 years. All but two patients (93.3%) complained of abdominal pain. Twenty-three patients (76.7%) had noted a change in bowel habits and 13 (43.3%) were aware of losing weight. Abdominal distension was reported by nine patients (30%) and rectal bleeding by seven (23.3%). Clinical evidence of large bowel obstruction was present on physical examination in all 30 patients. Abdominal tenderness of sufficient magnitude to suggest perforation was also present in 17 patients (56.7%). Fourteen patients (46.7%) had palpable abdominal masses and two (6.7%) had rectal masses. Laboratory studies revealed an anemia in seven (23.3%) patients. The stool guaiac test for occult blood was performed in 23 patients (76.7%) and was positive in 18 (78.3%). Proctoscopy was carried out in nine (30%) patients and was positive in six (66.6%). Barium enema x-ray examination of the colon was performed in 23 patients (76.7%) and was positive in 22 (95.7%).

The clinical status or extent of the disease present at the time of admission was such that curative operations were performed in 18 patients (60.0%) and palliative procedures in 11 (36.7%). In the latter group a palliative resection of the primary tumor was possible in only two patients. One patient refused operation.

The surgical procedures employed in the 29 patients operated upon are listed in Table 3. Bowel resection without preliminary colostomy was possible in 10 (55.6%) of the 18 patients who had curative procedures. However, in patients with carcinomas distal to the splenic flexure, a preliminary colostomy was utilized in six of eight patients with curative lesions. Resection of a segment of small bowel was necessary in six patients and a partial hysterectomy in one in order to remove all gross tumor. There were nine postoperative fatalities in the 29 patients operated upon, a mortality rate of 31.0 per cent. Three of 11 patients (27.3%) died following palliative operations and six of 18 patients (33.3%) after curative procedures.

There were only two patients (6.7%) with both obstruction and perforation of the large bowel due to carcinoma who survived 5 years (Fig. 4). Both survivors had Dukes B carcinomas.

Discussion

The data presented in this report confirm the clinical impression that patients with carcinoma of the colon and rectum which has progressed to the point of obstruction, perforation, or both, have a poor prognosis. The proportion of patients with these complications in whom curative resection is possible is diminished. In addition, operative mortality is high and 5-year survival rates are low. In 1969, the authors¹¹ reported their experience with 1,625 patients with carcinoma of the colon and rectum. Curative resections were feasible in 63.1 per cent of the patients. The operative mortality was 4.7 per cent and the 5-year sur-

TABLE 3. *Surgical Operations in 29 Patients with Obstruction and Perforation of the Colon Secondary to Carcinoma*

Palliative	11	
Colostomy	7	
Segmental resection of colon	2	
Exploratory laparotomy and biopsy	2	
Curative	18	
(A) With preliminary colostomy		8
Transverse colectomy	2	
Left colectomy	1	
Sigmoid colectomy	5	
(B) Without preliminary colostomy		10
Right colectomy	5	
Transverse colectomy	3	
Left colectomy	1	
Sigmoid colectomy	1	

vival rate 49.9 per cent. In patients with obstructing carcinoma, however, curative resections were performed in only 46.7 per cent, the operative mortality was 12.7 per cent and the 5-year survival rate 19.5 per cent. Perforation of a colo-rectal carcinoma, at least in this series, did not adversely affect the proportion of patients in whom curative resection was feasible (65.7%). However, the operative mortality was higher (15.3%) and the 5-year survival rate lower (28.3%) in comparison to our overall experience in patients with carcinoma of the colon and rectum. In patients with both obstruction and perforation, a curative resection is still possible in a high proportion of patients (60.0%) but the operative mortality is formidable (31.0%) and 5-year survivors are few (6.7%). In our present state of knowledge, improvement in survival statics can be achieved only by efforts to diagnose and treat patients before these complications have ensued.

Obstruction is the most frequent complication in patients with colo-rectal carcinoma. In most large series, it has been reported to occur in 3.8% to 23% of patients with this neoplasm. Successful management of these patients requires a knowledge of the metabolic consequences of the obstruction as well as an appreciation of the need

to extirpate the malignant lesion. Relief of the obstruction must take precedence in planning the surgical therapy. In patients with obstructing carcinoma of the right and proximal transverse colon, hemicolectomy with restoration of gastrointestinal continuity by end-to-end ileotransverse colostomy has been the most successful method of management. In patients with unresectable lesions in the right colon, a side-to-side ileotransverse colostomy can provide relief of the obstruction. In contrast, most patients with obstructing carcinoma in the distal segments of the large bowel require a preliminary decompressive operation before the tumor bearing segment of the colon can be resected. Adequate decompression has best been achieved by transverse colostomy. Cecostomy, in our experience, does not always provide adequate decompression and is associated with a high frequency of complications, particularly wound and peritoneal infection. Primary resection of obstructed lesions in the distal colon without preliminary colostomy has been advocated in recent years by several authors.¹⁻⁶ A recent review of patients at The New York Hospital-Cornell Medical Center who had primary resection of the distal colon for emergent conditions revealed that the operative mortality for such procedures was 27 per cent. In contrast, patients who had a preliminary colostomy and staged resection of the colon had a mortality rate of 6 per cent.¹² In view of this experience primary resection of the distal segments of the colon in the presence of acute obstruction would appear to have limited applicability. In some obstructed patients with rectal carcinoma who require abdomino-perineal resection, it may be feasible to carry out this procedure without a preliminary colostomy.

In view of the low 5-year survival rate for patients with obstructing carcinomas of the colon reported in this group of patients as well as others (Table 4), one must as-

sume that extensive intraluminal growth of the tumor is associated in many patients with comparable extraluminal spread. Therefore the extent of resection of the tumor bearing segment of colon and its mesentery and lymph node chains should be as wide as possible and yet not exceed the patient's tolerance for operative stress.

Published reports on the management of patients with perforating carcinoma of the colon are few. Donaldson⁴ in 1958 reported upon 182 patients from the Massachusetts General Hospital. The resectability rate was 68 per cent and operative mortality 53 per cent. Of the 73 patients who survived resection, 27 or 38 per cent survived 5 years. Miller *et al.*¹³ in 1966 collected a series of 284 patients treated at the Hospital of the University of Pennsylvania from 1940 until 1956. Included in this series were 213 patients with "fixation" of the tumor bearing segment of colon. Of this group of patients, inflammation was responsible for fixation in 54.8 per cent of the 73 cases where this was studied. There were 43 patients with perforation and abscess formation, 21 with enteric fistulae and seven with free perforation. The overall 5-year survival rate was 25.7 per cent.

Crowder and Cohn³ in 1967 reported 45 patients with perforating carcinoma of the colon. Twenty-nine of these patients also had partial or complete large bowel obstruction. The operative mortality rate was 55.5 per cent. Our experience also emphasizes the high operative mortality and low cure rate in patients with both obstruction and perforation due to carcinoma of the colon.

In general, most patients with walled off perforation of the colon or fistula due to carcinoma can be operated upon after adequate mechanical and antimicrobial preparation of the bowel. Under these conditions, primary resection with end-to-end anastomosis is feasible. A complementary proximal transverse colostomy is a useful safe-

TABLE 4. *Obstructing Carcinoma of the Colon as Reported from Representative Clinics*

Authors	Year	Total No. Patients	Per Cent			
			Obstructed	Curative Resection	Hospital or Operative Mortality	5-Year Survivals
Goligher and Smiddy ⁹	1957	1,664	17.6	44.1	34.1	—
Ulin <i>et al.</i> ¹⁶	1959	1,005	22.6	69.6	22.0	—
Welch and Burke ¹⁷	1962	1,886	3.8	—	17.0	33
Chang and Burnett ²	1962	465	23.0	—	22.6	19
Minster ¹⁴	1964	145	18.0	—	11.0	27
Loefer and Hafner ¹⁰	1964	573	15.0	—	39.0	11
Floyd and Cohn ⁵	1967	1,741	14.0	—	24.0	15
Glenn and McSherry	1971	1,815	11.6	47.6	12.4	19.5

guard in this group of patients. In patients with free perforations of the right and proximal transverse colon, primary resection with ileotransverse colostomy is the preferred operation. However, in patients with free perforation of the distal colon, a preliminary diverting colostomy followed by resection of the involved segment of bowel as soon as the patient's condition permits has been the most frequently employed approach. In those patients in whom immediate resection of the distal colon is mandatory, the Mickulicz technic has been used. The principal disadvantage of this procedure, however, is that it does not permit adequate resection of regional lymph nodes.

In view of the poor prognosis associated with the complications of obstruction and perforation in colon cancer, there is considerable interest in the development of new technics for early diagnosis. The recent reports by Gold^{8, 15} and coworkers on the detection of circulating carcinoembryonic antigen in the sera of patients with nonmetastatic carcinoma of the large bowel

are very significant. It is anticipated that this, or some similar immunologic technic, will be adapted for widespread use in the early detection of carcinoma of the colon and rectum and thus reduce the incidence of obstruction and perforation in these patients.

Summary

There were 1,815 patients admitted to The New York Hospital-Cornell Medical Center with carcinoma of the colon and rectum during the 33-year period from 1932-1965. Of this group, 210 patients (11.6%) had complete large bowel obstruction, 99 patients (5.5%) perforation, for 30 patients (1.7%) both obstruction and perforation of the large bowel. In patients and obstruction, curative resection was possible in 46.7%, the operative mortality was 12.7 per cent and the 5-year survival rate 19.5 per cent. Curative resections were performed in 65.7 per cent of the patients with perforating carcinoma and the operative mortality was 15.3 per cent and

the 5-year survival rate 28.3 per cent. In patients with both obstruction and perforation, curative resections were feasible in 60 per cent, the operative mortality was 31 per cent and the 5-year survival rate 6.7 per cent. Improvement in survival statistics can best be achieved by diagnosis and treatment before the onset of obstruction and/or perforation.

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