

Carcinoma of the Colon, Rectum and Anus *

BARTON MCSWAIN, M.D., ROBERT N. SADLER, M.D., F. BEACHLEY MAIN, M.D.

From the Departments of Surgery and Pathology, Vanderbilt University School of Medicine, Nashville, Tennessee

Relative Frequency

FROM the time Vanderbilt University Hospital opened on September 25, 1925, in the buildings which it presently occupies, through December 31, 1960, there were 708 cases of carcinoma of the colon, rectum and anus admitted. In an earlier paper¹ 252 cases were reported in the 24-year period from 1925 through 1948. In the 12 years from 1949 through 1960, there have been an additional 456 such patients, nearly twice as many in half as many years (Fig. 1). The diagnoses were based on the microscopic examination of the specimens submitted to the Surgical Pathology Laboratory at the Vanderbilt University Hospital.

From 1925 through 1955, there have been 476 cases diagnosed, following which five to 35 years have elapsed. We have followed 468 (98.3%) of these patients. Of 224 in the period from 1949 through 1955, 100 per cent have been followed (Table 1). We shall present data concerning the diagnostic criteria and treatment of 708 patients and follow up data on 468.

The frequency of carcinoma of the colon, rectum, and anus at the Vanderbilt University Hospital and throughout the United States is increasing. Death rates for carcinoma of the colon and other organs as reported by the United States Bureau of Vital Statistics in 1944 and 1959 is given in Table 2. The increase at Vanderbilt University Hospital is not only relative but also absolute when plotted against admis-

sions to the hospital during these periods (Fig. 2). One can see that carcinoma of the colon has increased from one per 737 admissions to one per 305 admissions, whereas during comparable periods, the incidence of carcinoma of the breast has decreased from one per 301 admissions in the earlier period to one of 366 admissions, currently. Of the 708 patients in this report, 347 were males and 361 females (Table 3). The number of males and females with carcinoma of the colon was nearly the same (Table 4). That carcinoma of the rectum and anus was slightly more common in females than in males is probably explained by the proximity of a large Veterans Administration Hospital to the Vanderbilt University Hospital.⁴ At the Thayer VA Hospital the number of cases of carcinoma of the colon, rectum and anus were as follows: 1948-52-53; 1953-57-58; 1958-61-75. Thus, the average number of patients per year has increased from 10.3 to 18.7. During this period, in our institution, there were 623 Caucasians and 85 Negroes, the ratio being approximately the same as the Caucasian to Negro admissions to the Vanderbilt University Hospital: nine to one (Table 5).

Duration of Symptoms

In the three periods (1925-1948, 1949-1955, 1956-1960), there has been a definite decrease in the time from the onset of symptoms until definitive treatment (Fig. 3). The delay has dropped from nearly 11½ months in the early period to less than 5½ months. It appears that there has been some improvement in lay education,

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particularly in the past five years, and, also some improvement in physicians' awareness of the need for complete evaluation of symptoms suggestive of large bowel disease.

Ages of Patients and Sites of Tumors

The age range was from 13 to 91 years. The percentages and number of cases in each decade are shown in Figure 4. One remarkable finding was that from 1925 through 1948, 10 per cent of patients were in the eighth decade, whereas, from 1949 through 1960 nearly one quarter were in the eighth decade (Fig. 5). These figures are in proportion to the over-all increased length of life in the population. From 1925 through 1948, less than two-thirds of the patients were in the sixth, seventh, and eighth decades, whereas from 1949 through 1960 over three quarters were in those decades (Fig. 6). The locations of the 708 cases of carcinoma of the colon, rectum, and anus, from 1925 through 1960, are shown in Figure 7.

Clinical Manifestations

Symptoms fall into definite categories according to three sites. The three locations were cecum, ascending colon through rectosigmoid and rectum and anus. Table

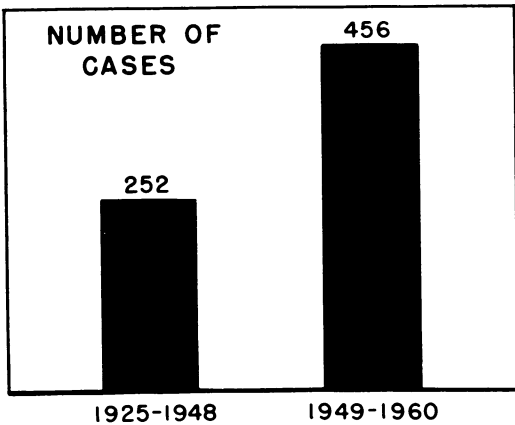


FIG. 1. Number of cases of carcinoma of colon, rectum, and anus in two periods.

TABLE 1. Follow up

1925-1955	468 Cases	Followed 5 to 35 years (98.3% follow up)
1949-1955	224 Cases	(100% follow up)
1956-1960	232 Cases	Less than 5-year follow up

TABLE 2. Deaths from Cancer in the United States

Site	Deaths in Thousands	
	1959	1944
Colon & rectum	38	30
Breast	23	16
Stomach	21	25
Lung & bronchus	17	10
Prostate	14	9
Pancreas	13	6
Cervix & corpus of uterus	9	17

TABLE 3. Sex Incidence, 1925-1960

	Male	Female
1925-1948	129	123
1949-1960	218	238
Totals	347	361

TABLE 4. Location of Tumor According to Sex

	Colon	Rectum & Anus
Male	225	122
Female	223	138

TABLE 5. Race Incidence, 1925-1960

	Caucasian	Negro
1925-1948	224	28
1949-1960	399	57
Totals	623	85

RELATIVE INCIDENCE OF CARCINOMA OF BREAST AND COLON

VANDERBILT UNIVERSITY HOSPITAL
1925-1960

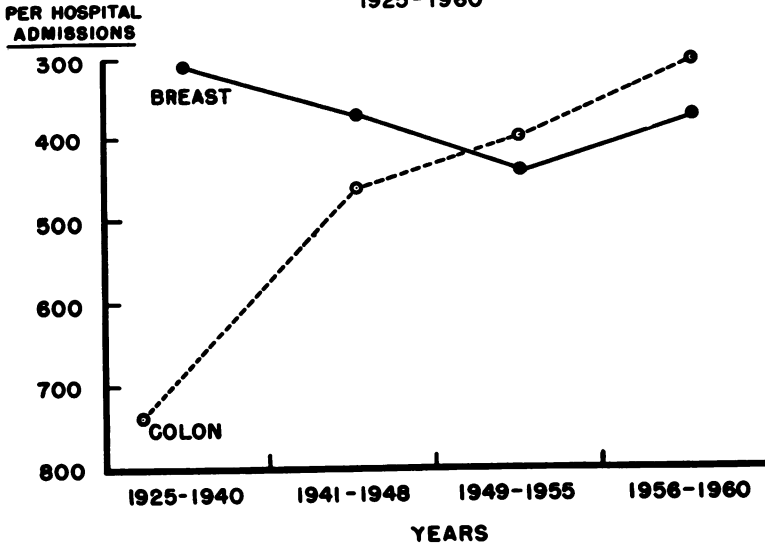


FIGURE 2.

6 shows the percentages of major symptoms of lesions at these three sites. The major symptoms in carcinoma of the cecum were pain (90%), weight loss (75%), and weakness (50%), with a mass being felt by the patient in 50 per cent. In the 359 cases of carcinoma of the colon from the ascending colon through the rectosigmoid, the major symptoms were change in bowel habits (78%), pain

(78%) and blood in the stools (70%). Symptoms of obstruction of the large bowel were the cause of admission in 42 per cent of patients with the lesions from the ascending colon through the rectosigmoid. This percentage is not significantly different from the percentage with symptoms of obstruction in cases of carcinoma of the cecum (38%). In carcinoma of the rectum, the major symptoms were bleeding (95%) and a change in bowel habits (84%).

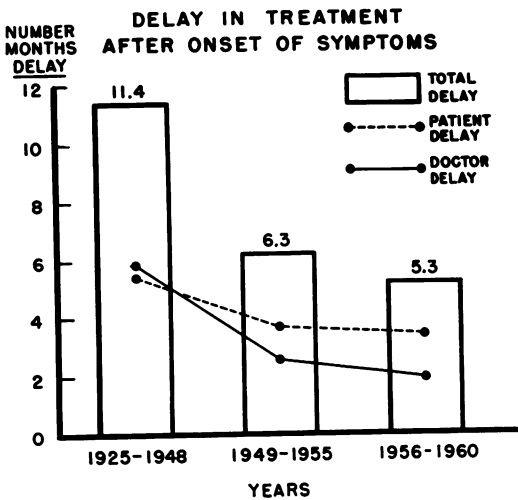
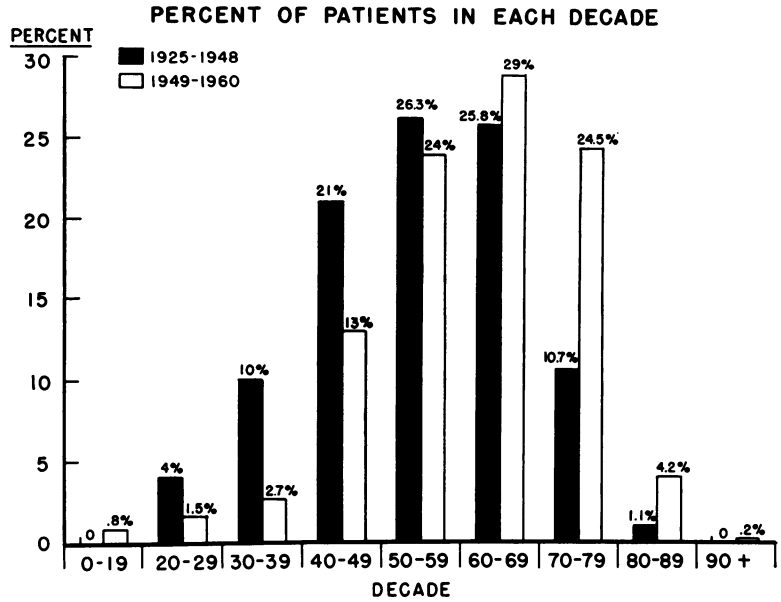


FIGURE 3.

We have tabulated symptoms of patients with carcinoma of the colon, rectum and anus, according to the first symptom recalled, and according to the symptom which precipitated hospitalization, the latter called the presenting symptom (Table 7). In 61 cases of carcinoma of the cecum, pain was the first symptom in 48 per cent and a mass was felt by the patient initially in 13 per cent. The presenting symptom in the cecal lesions was pain in 44 per cent and a palpable mass in 33 per cent.

In 359 cases of carcinoma of the ascending colon through the rectosigmoid junction, the first symptom was change in

FIG. 4. Age grouping of patients with carcinoma of colon, rectum, and anus.



bowel habits in 35 per cent and pain in 28 per cent. In this group only 17 per cent presented to the hospital complaining of change in bowel habits, 23 per cent with bleeding and 30 per cent with pain. Though a change in bowel habits was the most common first symptom, the symptom that brought them to the hospital was most commonly pain and blood in the stools.

Of 288 cases of carcinoma of the rectum and anus, the first symptom was change in bowel habits in 43 per cent and bleeding in 52 per cent, whereas the chief pre-

senting symptom was bleeding in 52 per cent, and change in bowel habits in 24 per cent. Thus, the most frequent symptom, and the one that causes the patient to seek medical advice, is bleeding.

In the study from 1925 through 1948, it was found that 10 per cent of patients had been treated for hemorrhoids, either by conservative treatment or hemorrhoidectomy, after the onset of symptoms which eventually led to the diagnosis of

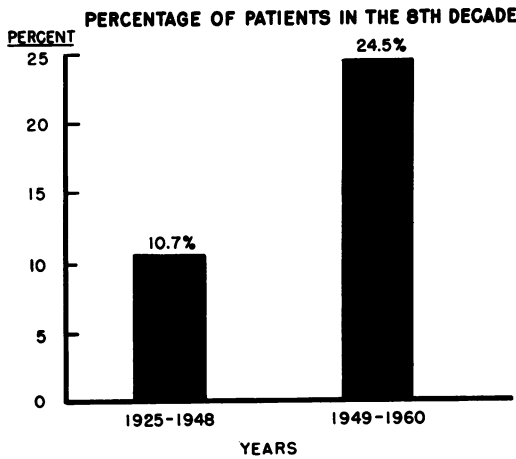


FIGURE 5.

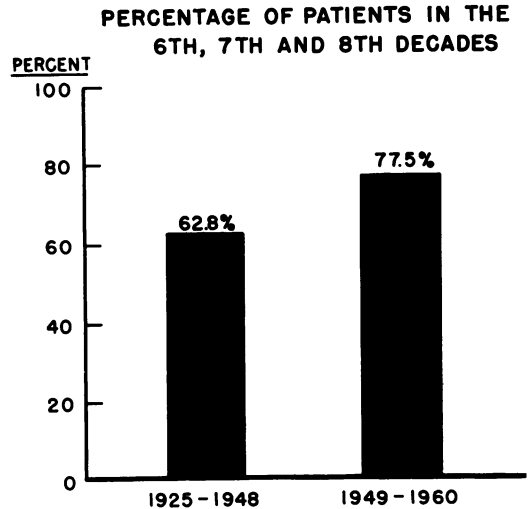


FIGURE 6.

TABLE 6. Major Symptoms of 708 Cases of Carcinoma of the Large Bowel

	61 Cases	359 Cases	288 Cases
	Cecum %	Ascending Colon →Recto-sigmoid %	Rectum and Anus %
Change in bowel habits	32	78	84
Melena	39	70	95
Pain	90	78	52
Weight loss	75	60	60
Weakness	50		
Obstruction	38	42	
Mass	50		

**LOCATION OF 708
CARCINOMAS OF THE LARGE BOWEL
VANDERBILT UNIVERSITY HOSPITAL
1925-1960**

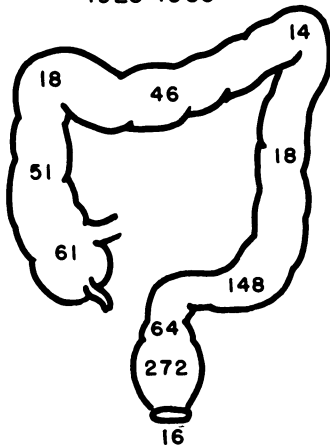


FIGURE 7.

carcinoma. Though there was a large number of prior hemorrhoidectomies in the second group of patients, from 1949 through 1960, only four of these had had hemorrhoidectomies within six months of the time that carcinoma was diagnosed and was unquestionably present at the time of hemorrhoidectomy.

Diagnostic Procedures

The most important diagnostic procedure in carcinomas of the large bowel is simple physical examination. By using the palpating hand on the abdomen or digital rectal examination, the diagnosis of carcinoma of the large bowel could be made in 431 of the 708 cases, or 60 per cent (Table 8).

A right lower quadrant mass was found in 80 per cent of the carcinomas of the cecum. An abdominal mass was found in

TABLE 7. Most Frequent First and Presenting Symptoms in 708 Cases of Carcinoma of the Large Bowel

	61 Cases		359 Cases		288 Cases	
	Cecum		Ascending Colon →Recto-Sigmoid		Rectum and Anus	
	First %	Presenting %	First %	Presenting %	First %	Presenting %
Change in bowel habits			35	17	43	24
Melena				23	52	52
Pain	48	44	28	30		
Mass	13	33				

an additional 32 per cent of the carcinomas that originated from the ascending colon through the rectosigmoid junction. Of the carcinomas of the rectum and anus, 93 per cent of 288 cases could be felt on digital rectal examination.

When one adds sigmoidoscopic examination, an additional 136 cases could be diagnosed, making a total of 567 of 708 cases (80%), that could be diagnosed by palpation of the abdomen, digital rectal examination, or sigmoidoscopy (Table 9).

By barium enema x-ray the radiologist made the correct diagnosis in 75 per cent of the carcinomas of the cecum, 90 per cent of carcinomas in ascending colon through the rectosigmoid junction, but in only 54 per cent of the carcinomas of the rectum and anus (Table 10). One could more frequently make the diagnosis of carcinoma of the cecum by palpating a mass in the right lower quadrant than by barium enema x-ray. Furthermore, one could more frequently make the diagnosis of carcinoma of the rectum and anus by a digital rectal examination than by the barium enema x-ray. We believe that in every case of carcinoma of the rectum and anus, a barium enema should be done to determine whether or not there are polyps or other carcinomas beyond the reach of the digital rectal examination and sigmoidoscopy. That 54 per cent of the cases of carcinoma of the rectum could be diagnosed by barium enema indicates that a large percentage of these lesions were either very high in the rectum, or far advanced.

In the earlier study (1925-1948) 54 per cent of cases (252) could be palpated on digital rectal examination, and 62 per cent could be palpated digitally or visualized through the sigmoidoscope. However, in the entire 708 patients, only 36 per cent could be felt rectally, and only 55 per cent could be palpated on digital rectal examination, or seen through the sigmoidoscope.

TABLE 8. *Physical Findings in 708 Cases of Carcinoma of the Large Bowel*

	61 Cases Cecum	359 Cases Ascending Colon →Recto- sigmoid	288 Cases Rectum and Anus
R.L.Q. mass	80%		
Abdominal mass		32%	
Rectal tumor			93%

(431 or 60% could be felt—nothing required but finger.)

TABLE 9. *Sigmoidoscopic Findings (Tumor Found on Sigmoidoscopy)*

Site	% of Total	Cases Diagnosed but not Found on Digital Rectal Exam
Sigmoid	40	59
Recto-sigmoid	93	60
Rectum and anus	99	17
		Total: 136 added by sigmoidoscopy

(Total cases found by palpation of abdomen, rectal examination and sigmoidoscopy = 567 or 80%.)

TABLE 10. *Barium Enema. Accuracy According to Location*

Cecum.....	75%
Ascending colon →Recto-sigmoid.....	90%
Rectum and anus.....	54%

TABLE 11. *Emergency Operations*

Site of Lesion	No. Cases	Deaths
Cecum	6	0
Ascending colon	4	0
Hepatic flexure	2	0
Transverse colon	6	1
Splenic flexure	7	1
Descending colon	6	1
Sigmoid colon	28	1
Rectosigmoid	6	1
Rectum	4	1
Anus	0	0
All Sites	70	6

TABLE 12. *Types of Emergency Operations Performed*

Site of Lesion	Operation Performed	1925-1948	1949-1960
Cecum	Ileo-transverse colostomy	1	0
Cecum	Right colectomy	1	2
Cecum	Incision and drainage of abscess	1	0
Ascending colon through rectosigmoid	Cecostomy	7	8
Ascending colon through rectosigmoid	Transverse colostomy	2	22
Ascending colon through rectosigmoid	Mikulicz resection	7	1
Ascending colon through rectosigmoid	Right colectomy	1	6
Ascending colon through rectosigmoid	Left colectomy with cecostomy	1	0
Ascending colon through rectosigmoid	Left colectomy without cecostomy	0	1
Ascending colon through rectosigmoid	Ileo-transverse colostomy	0	1
Ascending colon through rectosigmoid	Sigmoid colostomy	1	0
Ascending colon through rectosigmoid	Incision and drainage of abscess	0	1
Ascending colon through rectosigmoid	Laparotomy (disease not found)	1	0
Rectum	Transverse colostomy	0	2
Rectum	Sigmoid colostomy	1	0
Rectum	Abdomino-periineal resection	0	1

The fact that digital rectal and sigmoidoscopic examinations were not diagnostic in as many patients in the entire series may be because in the early series, 75 per cent of lesions were located at sites from the sigmoid colon distally to the anus, whereas, in the latter group, only 67 per cent were from the sigmoid colon distally. Thus, there was a greater increase in carcinomas of the colon than there was in carcinomas of the rectosigmoid and rectum, the latter being more readily detectable by digital rectal examination and sigmoidoscopic examination.

Emergency Operations

In 70 of the patients (10%) it was necessary to do emergency operations shortly after admission. The mortality in this group was 8.0 per cent. The sites of the lesions that required emergency operations, as well as the types of emergency operations performed, may be seen in Tables 11 and 12. There were few emergency operations necessary in cases of carcinoma of the rectum, whereas in carcinomas of the remainder of the colon, such procedures were approximately proportional to the frequency of the lesion occurring in that site.

The type of operation performed in cases of acute large bowel obstruction deserves some comment. In the earlier period (1925 through 1948), cecostomy and Mikulicz type resections were the most frequent operations performed. However, in the latter period (1949 through 1960), transverse colostomy and right colectomy were more frequently carried out, although there were still some patients in whom cecostomy was performed. Since, in several instances, the cecostomy did not function properly we now prefer transverse colostomy to cecostomy as an emergency procedure when the obstruction is to the left of the middle colic vessels. In some patients in whom laparotomy was performed because of a mass in the right lower quadrant and a carcinoma unexpectedly encountered, right colectomy was performed without preparation of the bowel. We have been pleased with the results in these few patients, inasmuch as there have been no deaths and no serious complications.

Involvement of Regional Nodes

The percentage of patients with microscopic evidence of carcinoma in the regional nodes is shown in Figure 8. There

was no appreciable change in the frequency of lymph node metastasis from 1941 through 1960; however, in the earlier period (1925 through 1940), the percentage of lymph node metastasis was significantly lower. This is most likely because the search for lymph nodes in the specimens was not as diligently carried out in the earlier group as it has been recently.

Polypoid Adenomas, Synchronous and Metachronous Carcinomas

Much interest has developed recently concerning the malignant potential of adenomatous polyps found in the colon and rectum. In seven of 708 patients the diagnosis of multiple polyposis was made; in each of these seven specimens more than one carcinoma was found. During this same period, benign polyps were found in association with carcinoma in 45 patients. The diagnosis of carcinoma was made on microscopic examination of specimens which grossly represented polyps in 66 patients. In these, the gross appearance of the lesion was that of a polyp and the microscopic diagnosis was carcinoma. In 24 patients, not including cases of multiple polyposis, there were synchronous carcinomas present.

Each of five patients subsequently de-

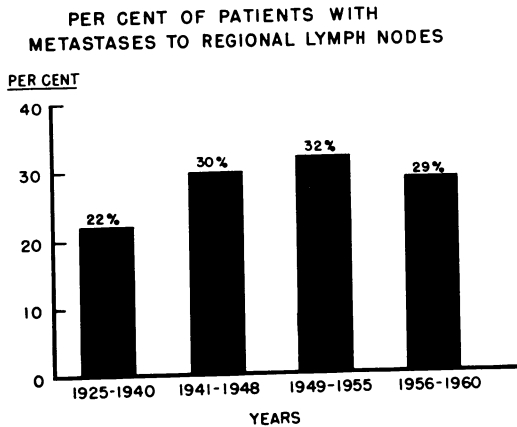


FIG. 8. Percentage of patients with carcinoma of colon, rectum, and anus who had metastasis to regional lymph nodes.

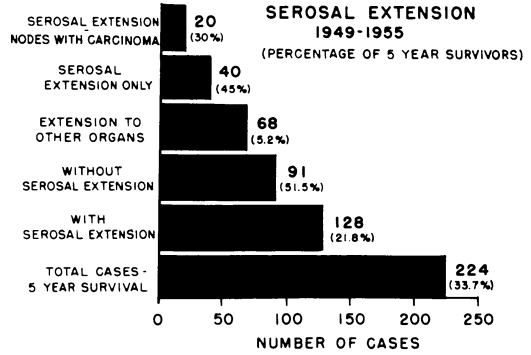


FIG. 9. Number of cases with various degrees of extension of carcinoma of the colon, rectum and anus. Percentage of 5-year survivors in each category shown in parentheses.

veloped a second carcinoma of the colon at a distant site. These were not recurrences at the site of anastomosis or colectomy. Furthermore, ten patients had had carcinoma of the colon prior to the time of inclusion in our report. One had an abdomino-perineal operation for carcinoma of the rectum in 1925. In 1960, 35 years later, she developed a second carcinoma of the left colon proximal to the colostomy and was subjected to left colectomy. In three patients carcinoma developed in the area of previously diagnosed ulcerative colitis.

Serosal Extension

An attempt was made to determine the prognostic significance of extension of the carcinoma through the serosa. This information was available in the 224 patients in the period from 1949 through 1955. During this period there were 75 five-year survivors, 33.7 per cent of the total. The percentage of five-year survivors according to the extent of the lesion is shown in Figure 9.

Five-year survivors with serosal extension associated with lymph node metastasis was 30 per cent, whereas five-year survivors of all those with lymph node metastasis only was 16.6 per cent. One might speculate on this basis that serosal extension was a favorable finding if there is

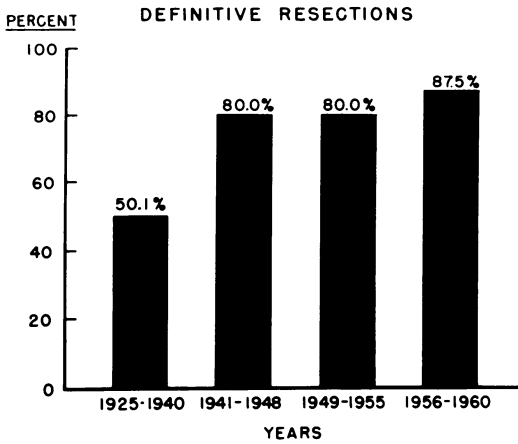


FIGURE 10.

metastatic tumor in lymph nodes, indicating a biological predeterminism to grow locally to a greater extent before spreading to regional lymph nodes. The very low survival rates in cases with spread to contiguous organs (5.2%) was to be expected. The high incidence of spread to contiguous organs, 68 (31%) of the total in this time period, may be a clue to the extremely poor five-year survival rate during this period.

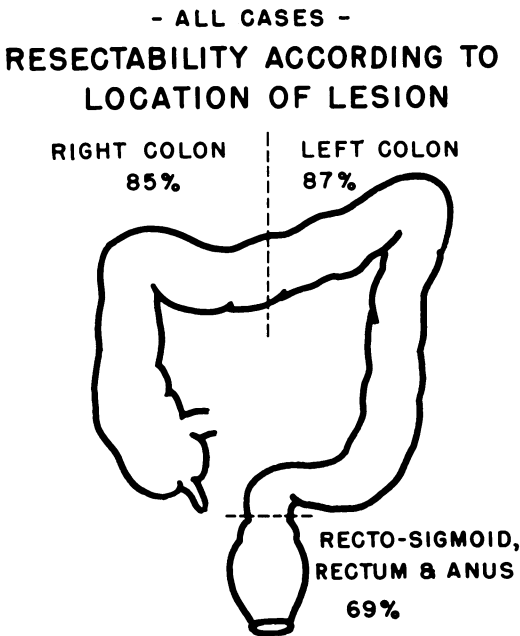


FIGURE 11.

Resectability

Figure 10 shows the increase in the percentage of patients in whom definitive resections were carried out. Improvement in resectability rates may be because patients were reaching a physician for definitive treatment earlier, or it could mean that surgeons are removing tumors which would have been considered inoperable during the earlier period. Resectability according to the location of the lesion is shown in Figure 11.

Operative Mortality

The operative mortality for three periods is shown for all cases, those that were resectable, and those that received palliative therapy only (Table 13). The decrease in over-all postoperative deaths from 25 to 4.3 per cent is striking. The operative mortality according to the location of the lesion is shown in Figure 12.

Results

There are 476 patients who have been treated for a period longer than five years, of whom 468 (98.3%) have been followed. The five-year survivors are determined on the total number of patients, those not followed being considered deceased. In Figure 13 are absolute five-year survival rates for the different periods.

In Figure 14 the five-year survival rate in those who had resectable tumors is shown. We believe that the decrease in the five-year survivals is due primarily to the extensive nature of the tumor when first seen during the period from 1949 through

TABLE 13. Operative Mortality

Years	All Cases (%)	Definitive Resection (%)	Palliative Procedures (%)
1925-1940	25	30	19
1941-1955	7.7	6.9	10.6
1956-1960	4.3	4.9	0

1955. In 31 per cent of the patients treated in this period the tumor had spread to other organs. Figure 14 also shows that from 1925 through 1940, five-year survival when corrected for resectability and operative mortality was 48.5 per cent, from 1941 through 1948 it was 50.9 per cent, and from 1949 through 1955, it was 45.4 per cent.

Five-year survival rate of those who had metastasis to the regional lymph nodes was exceedingly low (Fig. 15), but it was fairly good in all periods if lymph nodes were not involved.

Five-year survival of the 476 cases, from 1925 through 1955, according to the location, and corrected for operative mortality, is shown in Figure 16. Survival rate was highest in tumors of the right colon and lowest in those of the rectum.

From the earlier study (1925-1948) there were 74 five-year survivors. We have now followed this group to the present time, which is 11 to 35 years following original operation (Table 14). It was a disappointment to find that one quarter of these patients died of carcinoma of the colon five to 13 years after definitive treatment.

Type of Definitive Operation Performed

All lesions of the right colon were treated by standardized right colectomy and almost all of the lesions of the anus, rectum and rectosigmoid were treated by abdomino-perineal excision, either in one or two stages. Most remaining lesions of the colon were removed by local segmental resection, there being few cases in which total or hemicolectomy was carried out, and none in the period prior to 1956.

In the period from 1956 through 1960, for lesions of the transverse colon, one had complete colectomy with an ileoproctostomy. For the splenic flexure lesions five had left hemicolectomy. For descending colon, there were three who had left hemi-

- ALL CASES - OPERATIVE MORTALITY ACCORDING TO LOCATION OF LESION

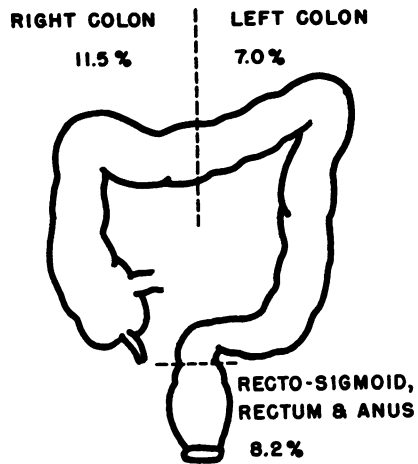


FIGURE 12.

colectomy. In the sigmoid area, eight patients had left hemicolectomy. One had total colectomy, and two had abdomino-perineal excisions in conjunction with left hemicolectomy. Most recto-sigmoid lesions were treated by abdomino-perineal operations with no hemicolectomies. The rectal lesions were usually treated by abdomino-perineal excision. Thus, there were only 20 cases of the entire series, and these all in the latter period from 1956 through

ABSOLUTE 5 YEAR SURVIVALS 476 CASES

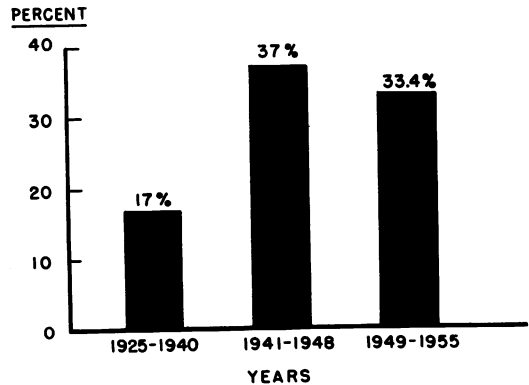


FIGURE 13.

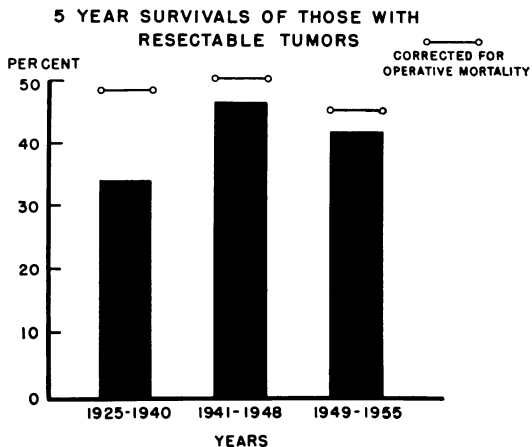


FIGURE 14.

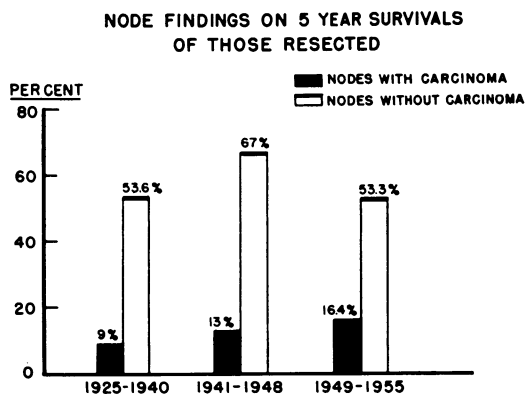


FIGURE 15.

5 YEAR SURVIVALS OF 476 CASES OF CARCINOMA OF THE LARGE BOWEL, 1925-1955 (ACCORDING TO LOCATION, CORRECTED FOR OPERATIVE MORTALITY)

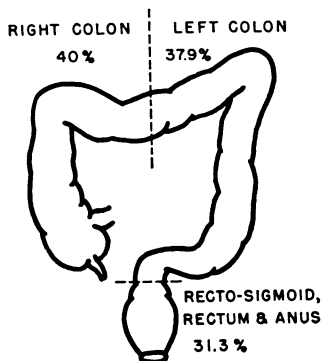


FIGURE 16.

1960, with lesions from the transverse colon distally, who were subjected to left hemicolectomy. The more radical procedures may improve subsequent five-year survival rates, particularly in patients with metastasis to the regional lymph nodes. During the last period (1956 through 1960) the Cole tapes were applied in almost every instance, and in most, control of venous drainage to the area was accomplished prior to mobilizing the tumor. This may be reflected in five-year survivors, five years hence.

Pull-through operation for lesions of the rectum was carried out only three times in the 1956 through 1960 period, and only once from 1949 through 1955. In the 1949 through 1955 period, the one who had pull-through operation was not a five-year survivor. We believe that this procedure for treatment of carcinoma of the rectum is rarely justified.

From 1956 through 1960, there were ten operative deaths, only one of which could be attributed to a surgical technical error resulting in generalized peritonitis. In the earlier period (1949 through 1955) four deaths were due to peritonitis, associated with leakage of anastomosis or gross contamination at the time of operation. In the earliest period (1925 through 1948) 14 of the operative deaths were associated with peritonitis.

Deaths attributable to technical errors and infection have therefore diminished from 45 per cent of the operative mortality in the 1925 through 1948 series, to 10 per cent of the total mortality in the 1956 through 1960 series. Whether this is be-

TABLE 14. Follow up of 74 5-Year Survivors from 1926-1948 Study

(Now Followed 11 to 35 Years)

19 Died of carcinoma of colon,	5-13 years
22 Died of other causes,	5-20 years
33 Living and well,	11-30 years

cause of improvement in the operative ability of the surgeons or the widespread use of antibiotics, one cannot be sure. However, improvement in operation mortality began in the era from 1941 through 1948, before the widespread use of antibiotics.

Comment

Carcinoma of the colon, rectum and anus, at the Vanderbilt University Hospital from 1925 through 1960 has increased in frequency. These tumors cause more deaths in the United States (Table 2) than any other carcinoma.^{2,3} Since there still remains room for improvement in early diagnosis, we are responsible not only for lay education but also for continued re-emphasis to medical students, house staff, and physicians. Complete examination of any patient with symptoms of abdominal pain, rectal bleeding and change in bowel habits is mandatory.

The population of the United States is growing older. The age incidence of patients with carcinoma of the colon is higher and one might anticipate that as the population continues to grow older, the incidence of carcinoma of the colon will continue to rise.

Carcinoma of the colon can be treated successfully with a high percentage of five-year survivors if the lesion is removed prior to the development of metastasis to the regional lymph nodes. At Vanderbilt University Hospital we believe that operation has not been sufficiently radical for lesions of the left colon, and during the past five years we have increased the extent of resection and plan to continue this in future years.

Theoretically, no operative mortality should occur from technical errors and the fact that only one did occur in the latter period is encouraging. The other causes of

death, such as pulmonary embolus and coronary thrombosis, are probably unavoidable. No patient of any age should have a hemorrhoidectomy for bleeding without having had sigmoidoscopic examination and barium enema. Furthermore, we believe that no patient with carcinoma of the colon or rectum should have definitive therapy until the entire colon has been examined for the presence of a synchronous carcinoma or polyps.

Summary

1. The relative frequency, clinical manifestations, diagnostic features and treatment of 708 cases of carcinoma of the colon, rectum and anus have been presented.
2. Follow up data have been recorded on 468 such patients.

Conclusions

1. Carcinoma of the colon, rectum and anus has increased in frequency in our institution and in the United States.
2. In our institution in recent years there has been:
 - a. A decrease in the interval from onset of symptoms until the time of definitive diagnosis.
 - b. An increase in the resectability.
 - c. A decrease in operative mortality.
 - d. No improvement in five-year survival except through decrease in operative mortality.

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