Enhanced Survival of Patients with Colon and Rectal Cancer is Based Upon Wide Anatomic Resection

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From 1966 through 1970 we performed resections in 216 patients with carcinoma of the large bowel. The relative five year survival for all patients was 65.5%. The relative five year survival for all potentially curable patients was 80.4%. Patients with positive lymph nodes and full-thickness penetration of their tumors had a five year survival of 70.5% and a 10 year survival of 60.5%. In performing this study we have tested the principles of wide anatomical resection and radical lymphadenectomy. For their specific influences on survival we have also examined stage, site, age, sex, race, margins, local recurrence, hypogastric lymph node dissection, serosal penetration and various aspects of nodal status. The information derived from these parameters has confirmed our hypothesis that survival is directly related to radical anatomical resection and lymphadenectomy. For rectal cancer, extensive resection also reduces the incidence of local recurrence. We are persuaded that the principles of operation for large-bowel cancer are valid and that they merit universal adoption.

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THE CURE of colon and rectal cancer, more than any other malignant tumor, is a singularly surgical endeavor. The major principles of the curative operations for large-bowel cancer have been established for nearly three-quarters of a century. These include the en bloc resection of lymph nodes to the origin of the named arteries supplying the colon and rectum according to Jamieson and Dobson[10] and Rouviere,[14] as is typified by high ligation of the inferior mesenteric artery for left-sided cancers, resection of the zone of upward spread in rectal cancers according to Miles[11] and wide pelvic and hypogastric lymph node dissection as practiced by Stearns and Deddish.[16]

Wide anatomical lymphadenectomy has been practiced at the various parent institutions with success. Two dilemmas remain: To our knowledge few institutions have consistently applied *all* of these principles to their surgical practice, and, more importantly, the concept of radical lymphadenectomy has not received uni-

versal application outside major surgical centers. We are convinced that this latter factor alone is responsible for an unwarranted national pessimism concerning the survival of patients with colorectal cancer.

Since the cure of colorectal cancer is almost exclusively surgical, we have chosen to examine the results of our own operative experience in which we have strictly adhered to all of the above principles. This study was undertaken to test these standards of surgical treatment.

Materials and Methods

From 1966 to 1970, 216 consecutive patients underwent a definitive laparotomy at the University of Chicago Hospitals and Clinics for the treatment of adenocarcinoma of the large bowel. Complete medical records were available for 186 patients (86.1%). Data for the remaining patients were obtained from operative records, surgical pathology reports and attending surgeons' records. All patients (100%) were followed until death or to the present time by the University of Chicago Registry for Neoplastic Diseases.

There were 118 males (54.6%) and 98 females (45.4%). One hundred thirty-four patients were white (62.0%), and 83 patients were black (38%). The mean age of our patients was 63.5 years, with 81% between 50 and 80 years of age and 30% over 70 years of age.

Pathological staging was performed according to the modified Dukes' classification of Astler and Coller[2] (Table 1). Further subsets of our data were analyzed by the modified Dukes' classification of the Gastrointestinal Tumor Study Group of the National Cancer Institute when deemed appropriate[9] (Table 2). Of the 216 patients, four were classified as Stage A (1.9%), 34 patients as Stage B_1 (15.7%), 68 patients as Stage B_2 (31.5%), three patients as Stage C_1 (1.4%), and 62 pa-

TABLE 1. *Modified Dukes' Classification of Astler and Coller (1954)*

Stage	Definition
A	Limited to mucosa
B_1	Invasion of muscularis mucosa, submucosa or muscularis propria
B_2	Complete penetration of muscularis propria
C_1	Invasion of muscularis mucosa; lymph nodes involved
C_2	Complete penetration of muscularis propria; lymph nodes involved

TABLE 3. *Distribution of Patients by Stage (Modified Dukes' Classification of Astler and Coller)**

Stage	Number	Per Cent
A	4	1.9
B_1	34	15.7
B_2	68	31.5
C_1	3	1.4
C_2	62	28.7
D	45	20.8
	216	100.0

* 61.6% B_2, C_1 or C_2.

tients as Stage C_2 (28.7%). Forty-five patients (20.8%) were Stage D on accession to treatment. Thus, 61.6% of our patients had advanced but potentially curable primary tumors (Table 3). Patient distribution by pathological stage was essentially unchanged from either the original Astler-Coller series or from our earlier study on the survival of aged patients, indicating no apparent bias in our patient selection[3] (Table 4).

The distribution of patients by the site of their primary tumors revealed that 31 (14.4%) had tumors of the cecum, ten (4.6%) of the ascending colon, 14 (6.5%) of the heptaic flexure, 16 (7.4%) of the transverse colon, 18 (8.3%) of the splenic flexure, 11 (5.1%) of the descending colon, 46 (21.3%) of the sigmoid, 22 (10.2%) of the rectosigmoid and 48 (22.2%) of the rectum (Table 5).

Cancer of the rectum was defined as any tumor of which the lowest edge was within 12 cm of the anal verge on preoperative proctoscopy in Depage's position. By this definition, 48 patients (22.2%) had cancer of the rectum, while 168 patients (77.8%) had tumors of the intra-abdominal colon.

Data was also obtained regarding the distance of the proximal and distal resected margins from the primary tumor (fresh specimen as measured by the pathologist), the gross architecture of the tumor, tumor size, histologic degree of differentiation, number of nodes examined per specimen, number of positive nodes and nodal ratios. All specimens were examined and the staging supervised by one surgical pathologist (Dr. Charles E. Platz) during the period of this study.

Statistical evaluation was performed using the Cox regression model.[5] Five year and ten year survivals were examined as absolute survival (taking into ac-

count all causes of death in the cohort), relative survival (death due to cancer only) and survival by life table analysis. Statistical significance at the 5% confidence level was established when the coefficient β was equal to or greater than twice the standard error for any given variable.

Method of Operation

Our operative methods and principles of radical lymphadenectomy have been previously presented in detail.[8] Two items merit special comment. First, sigmoid cancers are generally treated by wide sigmoid resection based on the origin of the inferior mesenteric artery. In addition, both the left common iliac and the aortic-caval bifurcation lymph nodes are frequently dissected with the specimen. Secondly, adjacent organs, *i.e.*, bladder, posterior vaginal wall, prostate or other intra-abdominal and retroperitoneal organs are included in the resection wherever contiguous spread or adherence are evident.

Results

Survival

Fourteen of the 216 patients (6.4%) died within 60 days of operation. The absolute five year survival for all stages of disease (Stages A through D), including those patients with rectal cancer, was 52.8%. The absolute five year survival for all patients without distant metastases (Stages A through C_2) was 65.3%. The relative

TABLE 2. *Modified Dukes' Classification of the Gastrointestinal Tumor Study Group*

Stage	Definition
A	Limited to mucosa
B_1	Invasion of muscularis mucosa, submucosa or muscularis propria
B_2	Invasion of serosa
C_1	One to four lymph nodes involved by tumor
C_2	Five or more lymph nodes involved by tumor
D	Distant metastases

TABLE 4. *Per Cent Distribution of Patients by Stage from 1954–1979*

Modified Dukes' Stage	1954 Astler-Coller	1971 Block/Enker	1979 Enker et al.	Including Stage D
A	0.3	5.0	2.3	1.9
B_1	13.6	18.3	19.9	15.7
B_2	46.6	43.3	39.8	31.1
C_1	4.0	3.4	1.8	1.4
C_2	35.0	30.0	36.3	28.7
D				20.8

TABLE 5. *Distribution of Patients by Site of Primary Tumor*

Site	Number	Per Cent
Cecum	31	14.4
Ascending colon	10	4.6
Hepatic flexure	14	6.5
Transverse colon	16	7.4
Splenic flexure	18	8.3
Descending colon	11	5.1
Sigmoid colon	46	21.3
Rectosigmoid	22	10.2
Rectum	48	22.2
	216	100.0

five year survival for patients with all stages of disease (Stages A through D) was 65.5%. The relative five year survival for patients without distant metastases (Stages A through C_2) was 80.4%. Life table analysis confirmed the high survival by stage observed in the relative survival of patients without distant metastases (Table 6).

While survival was excellent for all stages of curable disease, the rate of death was revealing. Unlike other reported studies, the slope of the survival curves in each group was gradual without precipitous decline in the first two years, suggesting a gradual recurrence of tumor following adequate resection (Fig. 1).

Patients with full-thickness penetration of the bowel wall and involvement of lymph nodes (Dukes' C_2) experienced a 70.5% relative five year survival. At ten years the relative survival for Stage C_2 was 60.7%, indicating that these patients continued to be at risk well beyond the traditional five year period.

The site of the primary tumor had a significant influence on survival. As in other series, patients with rectal cancer did not fare as well as those with intra-abdominal neoplasms. There were no Stage A patients with rectal cancer. Of the 48 patients with rectal cancer, 14 had distant metastases and only one of these patients survived five years. The total survival at five years for all patients with rectal cancer, regardless of stage, was 45.5% (20 to 44 patients). Of the 34 potentially curable patients, four died after operation and 19 of the remaining 30 survived five years (relative survival 63.3%). There was no appreciable difference in
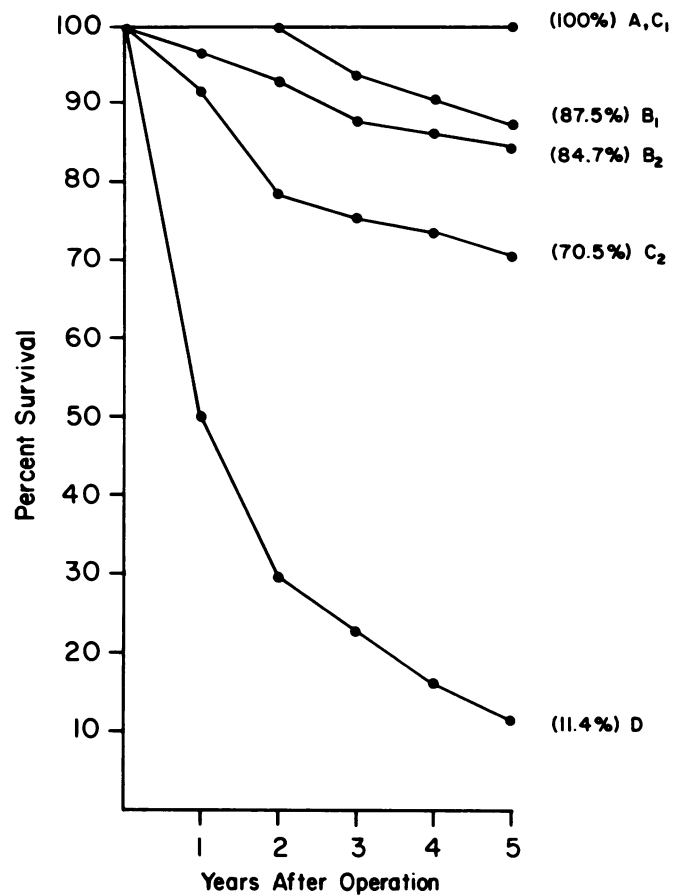

FIG. 1. The relative survival for all patients is graphically displayed. Note that with the exception of patients with widespread metastatic disease (Stage D) the decline in survival is gradual in all groups, without precipitous decline in the first 2 years.

the survival of our patients with rectal cancer whether the patients were designated as having a rectal cancer by proctoscopic height or by their tumor's extraperitoneal location as determined at laparotomy (Table 7). Our nine patients with cancer of the ascending colon fared poorly. The relative five year survival for this group was 55.6% (five of the nine patients).

TABLE 6. *Per Cent 5-Year Survival by Stage of Disease*

Modified Dukes' Stage	Absolute Survival	Relative Survival	Life Table Analysis
A	100.0	100.0	100.0
B_1	73.5	87.5	87.0
B_2	64.7	84.7	82.5
C_1	66.7	100.0	100.0
C_2	56.5	70.5	67.4
D	4.4	11.4	6.5

TABLE 7. *Per Cent 5-Year Survival of Patients with Rectal Cancer*

Dukes' Stage	Defined by			
	Proctoscopic Height Less than 12 cm		Extraperitoneal Location at Operation	
	No.	Per Cent Survival	No.	Per Cent Survival
A	0		0	
B_1	10	87.5	15	76.9
B_2	10	62.5	17	64.3
C_2	0		0	
C_2	14	50.0	21	55.0
D	14	7.1	17	11.8

TABLE 8. *Per Cent Incidence of Local Recurrence by Stage (All Sites) and by Distal Resected Margin (Length in Centimeters).*

Dukes' Stage	Length of Distal Margin	Local Recurrence Rate (%)	
		No.	Per Cent
B_1 or B_2	≤5 cm	6/30	20.0
	>5 cm	5/72	6.9
C_1 or C_2	≤10 cm	14/38	36.8
	>10 cm	2/27	7.4

Areas of Known Surgical Failure

We next turned our attention to the areas of surgical failure in order to substantiate our hypothesis that wide anatomical resection and lymphadenectomy are the key elements in the control of this disease. Aside from examining survival as the absolute measure of success, we have also analyzed the following parameters for their influence on the outcome of treatment; stage, local recurrence, distal margins, hypogastric lymph node dissection in rectal cancers, number of lymph nodes involved by cancer, total number of nodes in the resected specimens, nodal ratios and serosal penetration.

Local Recurrence vs. Margins and Stage

While the local recurrence rate at any site of disease was directly related to stage, it was also related to the length of the distal resected margin. In patients with Stages B_1 or B_2 carcinoma, a distal margin of greater than 5 cm was associated with a 6.9% rate of local recurrence. A margin of less than 5 cm resulted in a local recurrence of 20%. For patients with C_2 tumors, in which the three-dimensional extent of local disease was obviously great, a wide anatomical resection with greater margins in all planes was necessary to encompass the tumor. Thus, a distal margin of 10 cm or greater was necessary in order to maintain a rate of local recurrence equal to that seen in patients with Stage B_1 or B_2 disease. Margins of 10 cm or less were associated with a 36.8% rate of local recurrence (Table 8). The rate of local recurrences, stage by stage, was clearly related to the extent of the resection even when judged by the length of the distal margin alone.

Local Recurrence in Tumors of the Rectum and Rectosigmoid

The local recurrence rate for tumors of the rectum and rectosigmoid, including those instances observed after five years, bore a direct relationship to the stage of disease at the time of operation. The local recurrence rate for Stage B_1 was 9.4% and for Stage B_2, 11.9%. Patients with Stage C_2 disease of the rectum and recto-

TABLE 9. *Incidence of Local Pelvic Recurrence in Rectal and Rectosigmoid Cancer by Stage*

Dukes' Stage	Local Recurrence Rate (%)
B_1	9.4
B_2	11.9
C_2	27.9

sigmoid experienced a local recurrence rate of 27.9% (Table 9).

Hypogastric Lymph Node Dissection

The influence of wide lateral pelvic dissection on the rate of local recurrence in rectal cancer was also examined. While the number of our patients with full-thickness tumors and involved nodes is small, it is reasonable to examine the results of their treatment. Of the 14 patients with C_2 rectal cancers, five (35.7%) developed a local recurrence after resection. All of the three patients who did not undergo a concomitant hypogastric node dissection developed a local recurrence (100%), while only two of the 11 patients in whom a hypogastric lymph node dissection was performed developed a local recurrence (18.2%) (Table 10). As relates to the resection of rectal cancer, the rate of local recurrence in patients with extensive carcinoma of the rectum (Dukes' C_2) was kept to a minimum by extending the plane of dissection to the lateral muscular boundaries of the pelvic wall.

Extent of Resection as Determined by the Pathologists' Criteria

A further judgment concerning the extent of any given resection was based upon the total number of nodes retrieved from the resected specimen. The examination of all specimens consistently by one pathologist has enabled us to generalize on the basis of this data, albeit subjectively. There were 65 patients in Stages C_1 and C_2, *i.e.*, with nodal involvement. The patients were divided into those with ten or fewer nodes found in the resected specimen and those with greater than ten nodes. The mean survival for patients with one to ten nodes in the specimen was 53.2 months, with 45%

TABLE 10. *The Influence of Hypogastric Node Dissection on the Local Recurrence Rate in Patients with C_2 Rectal Cancers*

Hypogastric Lymph Node Dissection	No.	Local Recurrences
Performed	11	2 (18.2%)
Not performed	3	3 (100%)
	14	5 (35.7%)

TABLE 11. *Comparison of Low Anterior Resection vs. Abdominoperineal Resection in the Treatment of Rectal Carcinoma*

	Low Anterior Resection (N = 11)	Abdomino- perineal Resection (N = 33)
Stages B_1 or B_2	36.4%	45.5%
Stages C_1 or C_2	63.6%	54.5%
Relative 5-year survival (all stages)	52.4%	41.4%
Relative 5-year survival (Stages B_1–C_2)	87.5%	63.6%
Local recurrence rate	12.5%	24.0%

of the patients dying from metastatic cancer. By contrast, patients with more than ten nodes in the specimen had a mean survival of 71.2 months, and only 26.7% of these patients died from metastatic cancer.

Thus, an examination of surgical failures and the influence of margins, wide pelvic dissection and radical mesenteric resection confirms our hypothesis that wide anatomical resection and lymphadenectomy result in enhanced survival, a decreased incidence of local recurrence and fewer deaths due to cancer.

The Operative Management of Rectal Cancer

The influence of the type of operation upon survival was examined in patients with rectal cancer. Of the 48 patients with rectal cancer, three were treated with limited or partial proctectomy (less than 20 cm total specimen length) for palliation. All died as a consequence of their disease soon after recovering from operation. One patient with a B_1 carcinoma arising in chronic ulcerative colitis was treated by total proctocolectomy with the proctectomy performed in a radical fashion. This patient is alive and well more than 100 months following operation. Of the remaining patients, 33 (68.0%) underwent an abdominoperineal resection, and 11 (22.9%) a low anterior resection. For the patients undergoing abdominoperineal resection, the operative mortality was 12.1%, but no deaths occurred in the patients undergoing low anterior resection. Many of these deaths were related to hemorrhage, perineal sepsis or to the need for reoperation (28.6%). The majority of patients undergoing abdominoperineal resection had less advanced tumors when compared to those in the low anterior resection group (45.5% vs. 36.4% Stage B tumors and 54.5% vs. 63.7% Stage C or D tumors, respectively). The five year survival in patients undergoing low anterior resection was nearly 20% better than that observed in patients undergoing abdominoperineal resection, despite the apparent advantage by stage in the latter group (Table 11). From this data it is apparent that, when properly selected, the low anterior resection is a worthwhile procedure

which does not *per se* compromise survival. The decision to perform a low anterior resection remains an intraoperative one and is based upon the ability to accomplish a wide pelvic dissection with a 5 cm margin while preserving a distal segment of rectum sufficient to accommodate an anastomosis. This intraoperative selection of appropriate tumors may account for the apparently enhanced survival following low anterior resections.[6]

Alternative Factors in Staging and Prognosis

The prognostic importance of positive lymph nodes and muscular penetration of the bowel wall are acknowledged. However, the modified Dukes' classification of Astler and Coller does not take into account the prognostic significance of either the number of involved lymph nodes or the presence or absence of serosal extension. It is apparent, nevertheless, that patients with only one or two involved nodes and those without complete transmural penetration have a considerably better course than patients with extensive nodal involvement or pericolic invasion. For this reason we have re-examined subsets of our data according to the modified Dukes' classification of the Gastrointestinal Tumor Study Group in which these two factors are taken into account.[9]

The 65 patients with positive lymph nodes (Stages C_1 and C_2) but without distant metastases were divided into Stages C_1 and C_2 of the Gastrointestinal Tumor Study Group Dukes' classification. Stage C_1 represents patients with one to four positive lymph nodes, while Stage C_2 includes patients with five or more positive nodes divorced from any consideration of penetration by the primary tumor. The 51 patients with C_1 disease had a mean survival of 73.4 months, and 27.5% of these patients died from recurrent cancer. In contrast, those with five or more positive nodes (C_2) had a mean survival of only 58.9 months, with 50% dying of metastatic disease. When the patients were divided by the presence or absence of serosal involvement, the relative five year survival rate was appreciably less for patients with serosal extension. In patients without lymph node involvement the difference in survival was 12.1%, and for patients with lymph node involvement there was a 22.3% inferior survival in those patients with serosal extension (Table 12). These data confirm the value of the Gastrointestinal Tumor Study Group's staging method as a refinement of the original Astler and Coller Dukes' classification for determining prognosis.

Lymph node ratios (positive/total) were of little prognostic significance, with no clear pattern of death or survival until 70% or more of the examined lymph nodes were found to contain tumor (Fig. 2).

Additional Parameters Affecting Survival

As expected, the five year survival for women (70.7%) was slightly better than that for men (65.0%). However, contrary to prevailing opinion, the five year survival for black patients (74.4%) exceeded that of white patients (63.4%). There was a 20% increase in the death rate per decade of age above the mean of 63.5 years. Patients with well-differentiated tumors experienced a five year survival of 69.7%, while those with poorly differentiated tumors had a 50.0% five year survival. The presence of an exophytic or polypoid cancer was associated with a five year survival of 76.8%, while the patient with infiltrative or sessile cancers had a five year survival of 63.3%.

Obstructing colon cancers had a poorer prognosis. Patients without radiologic evidence of obstruction had a five year survival of 72.0%, while those with obstruction had a five year survival of only 54.2%. There was no difference in the operative mortality of the groups with or without radiographic evidence of obstruction. Only four patients with perforating tumors were treated during this period.

Statistically significant differences in survival were attributable to age, site (rectum and ascending colon) and Stage D disease, while pericolic extension approached a significance level of p = .08.

Operative Complications and Deaths

There were 25 intraoperative complications of significance in our 216 patients. Six of these 25 patients died as a direct result of an intraoperative complica-

TABLE 12. *Influence of Serosal Penetration or Pericolic Invasion on Survival*

Stage	Serosal Penetration	No. Patients	Per Cent Relative Five-Year Survival		Per Cent Absolute Five-Year Survival
B₂	Absent	27	74.1		90.9
	Present	41	63.4		78.8
				Difference	12.1%
C₂	Absent	16	62.5		83.3
	Present	46	54.3		61.0
				Difference	22.3%*

* β = .7686 ± .4378, p = .08.

tion. The majority of these deaths were associated with either excessive bleeding or contamination. While there were nine instances of visceral injury recognized by the operating surgeon, only one patient, who had an injury to the left ureter, ultimately died as a consequence of a recognized injury to an adjacent structure (Table 13).

Fourteen patients (6.4%) died within 60 days of operation. There were 21 recognizable complications contributing to death. Fifteen of these were related to operative or management errors. Five patients died as a consequence of bleeding, and three patients (1.6%) died as a consequence of anastomotic leaks. Six of the 21 complications were not directly related to operative technique, four of these were myocardial infarction (Table 14). Utilizing the same techniques and principles of operative management, our operative mortality has been 1.9% during the past three years.
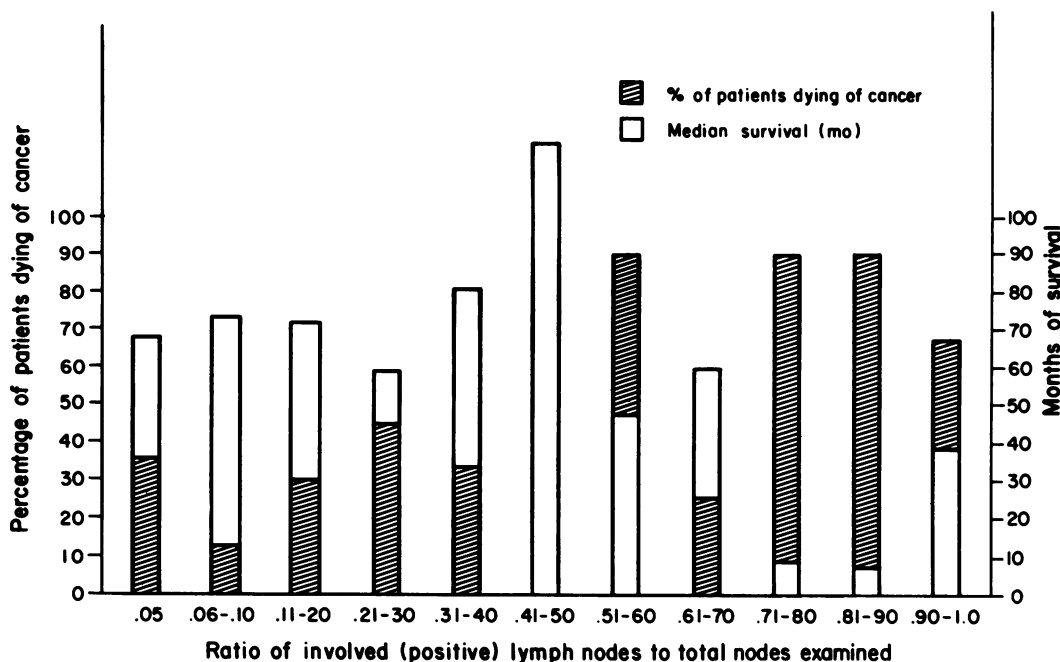

FIG. 2. The influence of nodal ratios on prognosis. Median survival in months and the per cent of patients dying from cancer are plotted for the various ratios of positive lymph nodes to total nodes examined. There is no consistent pattern of survival or death until a ratio of .71 or greater is achieved.

TABLE 13. *Intraoperative Complications*

Complication	No.	Related Deaths
Bleeding (>2 liters)	5	2
Contamination	11	3
Visceral injury	9	1
Spleen	2	
Bladder	2	
Intestine	2	
Ureter	1	(1)
Liver	1	
Pancreas	1	
Total	25	6 (24.0%)

Discussion

The data in this consecutive series confirm and underscore the value of the established principles for operating on large bowel cancer. By the method described above, we have been able to offer a relative five year survival, which is tantamount to cure, to 80.4% of all patients with colon cancer and to 63.3% of the patients with rectal cancer who do not have distant peritoneal seeding or liver involvement at the time of operation. This is true despite the fact that 61.6% of these patients had advanced but potentially curable primary tumors, while 38.4% of these patients had tumors limited to "all coats" of the bowel wall.

When we compare these survival figures with other published data it is clear that the prevailing national pessimism concerning survival from colorectal cancer is unwarranted. In a recent study by the American Cancer Society, it was demonstrated that the national and Illinois survival figures are extremely comparable, if not virtually interchangeable. The National Cancer Institute End Results Data for 1965–1969, covering 9681 patients, indicate a relative five year survival of 43% for males and 46% for females.[7] The American Cancer Society statistics for 1968–1970 concerning the survival of 2555 patients treated at 32 hospitals indicated a relative five year survival of 45.6% for males and 48.1% for females.[1] Forty-six per cent of the patients in both series were males and 29% of the American Cancer Society's Illinois patients were designated Stage III (regional spread and/or involvement of regional lymph nodes). Only 11% were black, while 88% were white. In the present series 54.6% of our patients were male, and 38% were black, both of which factors are reported to negatively influence survival. Despite these less advantageous features, our own relative five year survival for all stages was 65.5% and 80.4% for patients with colorectal cancer in Stages A through C_2.

Furthermore in examining the survival by stage the five year survival of patients with Stage III took on even greater significance. In this group, which represents the greatest challenge to the surgeon, the five

year survival in institutions reporting ten or more patients varied from 10.3–45.5% (the latter figure covering only 11 patients). In the same report the observed five year survival of the 45 patients operated upon at our own institution was 66.6%. Thus, despite several negative prognostic features in our own patient population we have achieved a cure rate which is two to three times the local and national averages. We attribute this achievement to our strict adherence to the prescribed principles for operating on this disease. During the course of this study we did not systematically employ either chemotherapy or irradiation, except in patients with metastatic or recurrent disease.

Other institutions which have similarly persisted in their efforts to treat colon and rectal cancer according to these same principles have reported equally dramatic cure rates.[15] These reports strengthen our hypothesis and serve to reinforce our belief that the adoption of radical anatomic resection and lymphadenectomy as practiced at the various major centers would improve the national success rate.

These operative principles have been known to surgeons for nearly 75 years. Thirty years prior to the classic contribution of Rouviere,[14] the lymphatic-arterial supply of the colon and its surgical implications were exquisitely described by Jamieson and Dobson.[10] In the year 1908, Moynihan described the logic of and his experience with ligation of the inferior mesenteric artery at its origin for patients with cancers of the descending and sigmoid colon.[12] He emphasized that the only element standing in the way of a radical resection based upon ligation of the inferior mesenteric artery at its origin was the willingness of the surgeon to perform adequate mobilization of the splenic flexure for suitable reconstruction. When these works are viewed in combination with the honored contributions of Miles, it is apparent that the entire foundation for adequate resection of large bowel cancer was established by the year 1908.[11] While Moynihan translated the principles of high ligation into practice, it

TABLE 14. *Postoperative Complications Contributing to Operative Mortality*

All deaths		14 (6.4%)
Major complications		21 (9.7%)
Related to operative or postoperative management		15
Bleeding	5	
Anastomotic leak	3	
Sepsis (undefined)	3	
Mechanical ileus	2	
Wound infection	1	
Aspiration pneumonia	1	
Related to operative risk		6
Myocardial infarction	4	
Cardiovascular accident	1	
Pneumonia	1	

was Rosi who provided an objective rationale for its use. Rosi et al. demonstrated that anywhere from 8–22% of patients with sigmoid carcinomas had lymph node metastases within 1–3 cm from the origin of the inferior mesenteric artery and that survival was directly affected by the level or arcade at which the mesentery was divided.[13] The role of the hypogastric lymph node dissection (in the unirradiated patient) and the prevention of intraoperative spread of disease followed later.[16] Cole et al.[4], and subsequently Turnbull et al.[17], were concerned with the possibility of spread of tumor by intraoperative manipulation, based upon the experimental work of Tyzzer.[18]

Turnbull et al. recently popularized the principles of radical colon resection. However, we are not persuaded that the success of his operative endeavors lies in the stepwise execution of his "no touch technique."[17] Rather, the anatomical scope of the resection, which is implicit in his method, results in a radical anatomic lymphadenectomy. In the present series no special attention was devoted to executing the "no touch" guidelines in any particular order. Despite this, our results in terms of survival exceed those of the Turnbull series on the "no touch technique." In the two comparable groups, Turnbull's Stage C patients and our Stage C_2 patients, the life table five year survivals were 57.8% and 67.4%, respectively. We are therefore persuaded that it is the anatomy and extent of the resection which is operative in cure, not so much its order of execution.

In the case of rectal cancer, the principles of adequate resection are the key determinants not only in regard to survival but also in reducing the rate of local recurrence. While the number of patients in this series is too small to judge any one factor in isolation, the combination of the data regarding stage, margins, hypogastric lymph node dissection and the number of nodes per specimen leads to the conclusion that the cure of rectal cancer is equated with radical pelvic and mesenteric lymphadenectomy. Since it is not our practice to routinely employ preoperative radiation in patients with rectal cancer, we have only infrequently encountered some of the difficulties inherent in hypogastric lymph node dissection that have been experienced in irradiated patients.

In 1908, Moynihan closed his paper on colorectal cancer with the statement "operations which merely go 'wide of the disease' do not meet the necessities of the case. We have not yet sufficiently realised that the surgery of malignant disease is not the surgery of organs: it is the anatomy of the lymphatic system."[12]

The same message is even clearer today after having borne the test of time. If the principles of radical curative resection of large bowel cancer were to be translated into common use, the national cure rate of this disease would rise and the prevailing pessimism would decline accordingly. We are persuaded that this study has served to emphasize the value of these principles.

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