

# The Relationship Between the Extent of Distal Clearance and Survival and Local Recurrence Rates After Curative Anterior Resection for Carcinoma of the Rectum

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With increasing use of low anterior resection, the length of rectum removed below the tumor is often less than the recommended 2 to 5 cm. It is important to know if this decreases the chance of cure. Between 1963 and 1975, 334 patients survived radical restorative operations for single rectal adenocarcinoma. The length of rectum below the tumor measured on fixed pinned-out pathologic specimens was 2 cm or less in 55 patients (group 1), 2 to 5 cm in 177 (group 2), and 5 cm or more in 102 (group 3). The Dukes' classification, histologic grade, and extent of local spread of the tumors were similar in the three groups. Overall crude 5-year survival rates for groups 1, 2, and 3 were 69.1%, 68.4%, and 69.6%, respectively. Corresponding cancer-specific death rates were 25.5%, 23.2%, and 21.6%. These rates were also similar in matching pathologic subgroups of the three main groups. Of 23 observed or suspected local recurrences, there were four recurrences in group 1 (7.3%), 11 in group 2 (6.2%), and eight in group 3 (7.8%). These results suggest that a margin less than 2 cm below a rectal carcinoma does not affect survival or local recurrence adversely.

THE LENGTH of normal rectum below a rectal carcinoma which should be removed by radical anterior resection remains a matter of controversy. Clearances ranging from 2 to 5 cm have been recommended, based primarily on pathologic studies.<sup>1-4</sup> As a result of the increasing use of restorative operations, there may be instances where distal clearance margins have been less than the recommended "safe" distances. If this is the case it is important to know whether the prospect of cure is adversely affected.

Restorative resection is defined as any procedure (*e.g.*, anterior resection, colo-anal anastomosis) in which intestinal continuity is restored.

To date, there is little information on the relationship between the extent of distal clearance and the clinical results after curative restorative resection for cancer.

This study, therefore, was undertaken to ascertain whether there is any correlation between the length of normal rectum removed below the tumor and survival and local recurrence rates.

## Materials and Methods

Records of all patients who survived curative anterior resection for primary adenocarcinoma of the rectum between the years 1963 and 1975 were reviewed. A curative or radical operation was defined as one in which the surgeon had felt that all known tumor had been removed. Patients with multiple primary tumors, either synchronous or metachronous, were excluded as were patients with ulcerative colitis or familial polyposis or those who had had a previous local excision.

The age, sex, Dukes' classification, extent of extra rectal spread, and histologic grade were recorded in each case, and the distance of the lower border of tumor from the anal verge, as assessed by preoperative sigmoidoscopy, was noted. The extent of extra rectal spread was determined by the pathologist on examination of the excised specimen and recorded as nil, slight, moderate, or extensive, based on the criteria of Dukes and Bussey.<sup>5</sup> The histologic grade was stated to be of low, average, or high grade of malignancy.

In most cases, the length (cm) of normal rectum below the lower border of the tumor was measured by the pathologist on formalin-fixed specimens that had been pinned out on a cork board to their natural length immediately following removal from the patient. A few specimens were fixed by filling the lumen with formalin to the approximate size *in vivo* after occlusion of both ends. This method was used only where there was a long distal margin, and none of the specimens with very short margins were processed in this way.

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TABLE 1. Five-Year Survival and Cancer Specific Death Rates in Groups 1, 2, and 3

	No.	Crude Survival Rate (%)	Age and Sex Corrected Survival Rate (%)	Cancer Specific Death Rate (%)
Group 1 ( $\leq 2$ cm)	55	69.1	82.5	25.5
Group 2 (2 to 5 cm)	177	68.4	83.3	23.2
Group 3 ( $\geq 5$ cm)	102	69.6	82.5	21.6
Total	334			

There was a total of 343 patients (197 males, 146 females) of whom nine were lost to follow-up and were excluded from further analysis. The remaining 334 patients were divided into three groups according to the length of normal rectum below the tumor as follows: group 1 (55 patients)  $\leq 2$  cm; group 2 (177 patients) 2 to 5 cm; group 3 (102 patients)  $\geq 5$  cm. Five-year survival rates and local recurrence rates were determined from the follow-up records. Seven patients (2%) died of an unknown cause within 5 years and were assumed to have died of cancer for the purpose of survival calculations. The cancer-specific death rate was calculated by adding all patients known to have died of cancer to those dying of an unknown cause and expressing this number as a percentage of the total. Local recurrence was inferred from histologic or strong clinical evidence of the appearance of cancer within the field of resection of the primary tumor during the period of the follow-up.

TABLE 2. Proportion of Pathologic Subgroups in Groups 1, 2, and 3

	Dukes Stage								
	A			B			C		
	1	2	3	1	2	3	1	2	3
Group	1	2	3	1	2	3	1	2	3
%	20	24	14	40	45	52	40	31	35
	Extent of Local Spread								
	Nil			Slight			Moderate to Extensive		
	1	2	3	1	2	3	1	2	3
Group	1	2	3	1	2	3	1	2	3
%	33	27	15	38	40	46	29	33	39
	Histological Grade								
	Low			Average			High		
	1	2	3	1	2	3	1	2	3
Group	1	2	3	1	2	3	1	2	3
%	27	25	31	56	67	64	16	7	5

TABLE 3. Crude 5-Year Survival in Groups 1, 2, and 3 with Respect to Dukes' Classification, Extent of Local Spread, and Histologic Grade

	Dukes Stage								
	A			B			C		
	1	2	3	1	2	3	1	2	3
Group	1	2	3	1	2	3	1	2	3
No. of patients	11	42	14	22	80	53	22	55	35
Alive 5 years	10	38	9	15	54	40	13	29	22
%	90	90	64	68	68	75	59	53	63
	Extent of Local Spread								
	Nil			Slight			Moderate to Extensive		
	1	2	3	1	2	3	1	2	3
Group	1	2	3	1	2	3	1	2	3
No. of patients	18	47	15	21	71	47	16	59	40
Alive 5 years	16	42	10	13	50	38	9	28	23
%	89	89	67	62	71	81	56	47	58
	Histological Grade								
	Low			Average			High		
	1	2	3	1	2	3	1	2	3
Group	1	2	3	1	2	3	1	2	3
No. of patients	15	45	32	31	119	65	9	13	5
Alive 5 years	11	35	25	22	81	43	5	5	2
%	73	78	79	71	68	66	56	38	40

The chi-square test or student's t-test of proportions were used in the statistical analysis of data. Differences were considered significant when  $p \leq 0.05$ . Age and sex corrections were performed to further standardize comparison between the three groups using a technique previously described by Dukes.<sup>6</sup>

**Results**

The 5-year survival rates of each group were remarkably similar, whether expressed as crude survival, survival corrected for age and sex, or as cancer-specific death rate (Table 1).

There was no significant difference between the proportions of Dukes' stages, extents of local spread, or histologic grades of tumors within groups 1, 2, and 3 (Table 2). Crude 5-year survival rates of groups 1, 2, and 3, with respect to these pathological attributes, were also similar (Table 3). In particular, crude survival of Dukes C cases in group 1 (59%) was not statistically different from that in group 3 (63%), and survival rates of cases with moderate or extensive spread in groups 1, 2, and 3 were 56%, 47%, and 58%, respectively. Although the number of patients was small (nine), there was no in-

TABLE 4. Local Recurrence Rates in Groups 1, 2, and 3

Group	Total	Local Recurrence (%)
1	55	4 (7.3%)
2	177	11 (6.2%)
3	102	8 (7.8%)
Total	334	

dication that group 1 patients with high grade tumors (crude survival rate, 56%) fared worse than those in groups 2 or 3 (crude survival rates, 38% and 40%, respectively).

Local pelvic recurrence was confirmed or strongly suspected in 23 cases. This represents a minimum number, since other recurrences may have occurred that were not apparent from available records such as death certificates. These observed rates were between 6% and 8% in all groups (Table 4). The individual cases with local recurrence are shown in Table 5.

In 20 patients suspected of suffering from local recurrence, histologic proof was obtained, but in three patients, the diagnosis was made on clinical suspicion. The anastomosis was involved in 10 of 23 patients with local recurrence. Recurrences involving the anastomosis often involved other pelvic structures.

Comparing the pathologic attributes of recurrences in groups 1, 2, and 3 (Table 5), there are no obvious differences. The principal pathologic features that are associated with recurrence are indicated in Table 6. There were significantly fewer local recurrences among patients with Dukes' A or with slight extra rectal spread; conversely, there were significantly more recurrences among those patients with Dukes' C category or with extensive local spread.

We were unable to demonstrate any association between histologic grade of tumor and local recurrence in this series, although the number of high grade tumors is small.

**Discussion**

The introduction of anterior resection<sup>7</sup> and further developments of restorative resection were the direct result of reappraisal by pathologists of the directions of spread of rectal cancer. Miles<sup>8</sup> believed that both direct and lymphatic spread occurred in all directions, including both upwards and downwards from the tumor. However, Westhues,<sup>1</sup> in a histopathologic analysis of total rectal excision specimens, found distal spread, whether intramural or extramural, beyond 1 cm to be rare.

This finding was corroborated by Goligher, Dukes,

TABLE 5. Details of Patients with Local Recurrence

Case	Dukes' Stage	Histologic Grade	Local Spread	Histologic Proof	Anastomosis Involved
Group 1					
1	C	Average	Moderate	+	+
2	B	Low	Slight	+	+
3	C	Average	Slight	+	+
4	B	High	Moderate	+	?
Group 2					
5	C	Average	Extensive	-	-
6	A	Average	Nil	-	-
7	C	Low	Slight	+	-
8	B	Average	Slight	+	-
9	B	Average	Extensive	+	-
10	B	Average	Extensive	+	-
11	B	Low	Slight	+	-
12	C	High	Extensive	+	+
13	B	Average	Extensive	+	+
14	B	Low	Moderate	+	-
15	C	Average	Extensive	+	+
Group 3					
16	C	Average	Extensive	+	+
17	C	Low	Slight	-	-
18	B	Low	Extensive	+	+
19	B	Average-high	Moderate	+	+
20	B	Average	Moderate	+	-
21	C	High	Extensive	+	+
22	C	Average	Moderate	+	-
23	C	Average	Extensive	+	-

TABLE 6. Pathologic Attributes of the Primary Tumor in Cases Developing Local Recurrence and Cases Without (Local) Recurrence

	Local Recurrences (23) % (N)	Non-Recurrences (311) % (N)
Dukes' stage		
A	4.3 (1)	21.2 (66)*
B	47.8 (11)	46.3 (144)
C	47.8 (11)	32.5 (101)*
Degree of local spread		
Nil	4.3 (1)	25.4 (79)*
Slight	26.1 (6)	42.7 (133)*
Moderate	26.1 (6)	19.2 (60)*
Extensive	43.5 (10)	12.5 (39)*
Histological grade		
Low	26.1 (6)	27.6 (86)
Average	60.9 (14)	64.6 (201)
High	13.0 (3)	7.7 (24)

\* Significantly different (p ≤ 0.05; t-test) from recurrence proportions in corresponding pathologic subgroups (e.g., 4.3% recurrences vs. 21.2% non recurrences were Dukes' A tumors).

and Bussey,<sup>9</sup> who reported distal spread in only 6.5% of 1500 specimens examined, this being more than 2 cm in only 2% of the specimens. Others have verified these observations.<sup>3,4</sup> Thus, the way was open for leaving a part of the rectum behind in some cases of rectal cancer, but the question was then raised as to how much or how little rectum below the tumor should reasonably be taken without risking local recurrence. Goligher et al.,<sup>9</sup> in a careful pathologic study of operative specimens from patients who developed recurrence, found a length of distal margin of 0.6 cm in two cases and suggested that a 2-cm margin of normal rectum below the tumor was too little, being likely to result in treatment failure. They recommended 5 cm as a safe distance, and this has subsequently become the orthodox "safe margin." There has, however, been a marked increase in the use of anterior resection and newer techniques for restoring intestinal continuity,<sup>10</sup> and preservation of anal function has become a goal in itself with, perhaps, a blind eye being turned towards the extent of distal clearance. A 5-cm margin is not possible if tumors at 7 or 8 cm from the anal verge are to be removed and intestinal continuity restored, since the anal canal itself is about 4 cm long. Wilson and Beahrs<sup>11</sup> suggested that there was no relationship between survival and the length of distal margin, but the cases in their study were not subdivided into pathologic categories. Therefore, it was not possible to determine whether the absence of any relationship was simply the result of case selection whereby sphincter preserving resections with short distal margins were carried out in cases with pathologically favorable tumors.

The present study shows, first, that there was no bias in the proportions of Dukes stage, extent of local spread, or histologic grade in any of the three margin groups and, second, that there was no significant difference in survival in matching pathologic subgroups of the three main groups. These findings were consistent with reports that survival after anterior resection growths of the middle<sup>12</sup> or upper rectum<sup>13</sup> was no different than after total rectal excision for tumors with similar pathologic features. Thus, it seems reasonable to conclude that long-term survival is not prejudiced by margins as little as 2 cm.

There is very real concern that local clearance may be prejudiced by the ill-judged use of restorative anastomosis, particularly with the availability of the circular stapler. Anecdotal reports of local recurrence are now beginning to appear, and it is quite apparent that very short margins may risk local recurrence.<sup>9</sup>

In the present study, there was no difference in local recurrence rates in any of the margin groups, and in the 23 documented cases of recurrence, the pathologic at-

tributes of extensive local spread and Dukes C stage were the predominant factors associated with local recurrence, as had been found by Morson et al.<sup>4</sup> It should be appreciated, however, that in very few (18) of the 55 tumors in group 1 was the distal margin less than 1.5 cm, and the finding of no reduction in survival or increase in local recurrence rates in group 1 cannot be said to apply to distal margins of around 1 cm, since there are too little data available to answer this question.

In the pathologic studies, many of the tumors found to have extended distally were of high grade of malignancy. Anaplastic tumors accounted for 65% of the 48 of the 546 cases examined by Penfold<sup>15</sup> in which such spread had occurred, and in most reports, extensive downward spread is virtually always associated with an advanced growth in which proximal lymphatics are blocked with tumor. Lymphatic spread normally follows an upward course until this advanced state of affairs is reached. It is most significant that no patient with downward spread survived 5 years in Penfold's study, and Grinnell<sup>16</sup> also found no survivor where retrograde lymphatic spread had occurred, even though his patients were treated by total rectal excision. In fact, we have been unable to find any case in the literature, even when treated by total rectal excision, with survival over 5 years in which distal spread was greater than 1.5 cm. This suggests, first, that little is lost in survival whether these growths are treated by rectal excision or anterior resection, since the prognosis is poor in either case and, second, as a corollary, that there should be no worse prospect of survival if a growth is removed by restorative resection with a distal margin around 2 cm.

It should be emphasized that we are not advocating a policy of minimal distal clearance in rectal cancer, but in the light of our results, it is clear that a 5 cm margin is unnecessarily long. There appears every justification to carry out a curative sphincter-preserving resection, taking a shorter length of rectum below the tumor in order to spare the patient a permanent colostomy. What the minimum length should be is impossible to answer dogmatically, but it seems reasonable from our results to propose 2 to 3 cm as a safe margin. It may be difficult during a dissection deep in the pelvis to be sure how much free distal rectum is available, and a general principle of as much as possible—up to 3 cm or so—would appear prudent.

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