

A CRITICAL EVALUATION OF SUBTOTAL GASTRECTOMY FOR THE CURE OF CANCER OF THE STOMACH*

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UNTIL A FEW YEARS AGO, the five-year salvage of patients treated for gastric cancer was generally regarded as negligible. Recent reports from the Mayo Clinic,¹ the Lahey Clinic,² and the Massachusetts General Hospital³ state that 20 to 30 per cent of those recovering from subtotal gastrectomy for cancer lived for five years without recurrence or metastases. Based on a 100 per cent follow-up of resection survivors, a report from the Gastric Service of Memorial Hospital records 34.7 per cent clinical cures in 75 patients treated prior to 1941.⁴

Despite the fact that these figures indicate a significant advance in the cure rate of patients suffering from gastric cancer, and despite the fact that the operative mortality for subtotal gastrectomy has been reduced to 15 per cent or less in many hospitals, there is little reason for smug self-satisfaction among surgeons. The overall five-year salvage in unselected patients with gastric cancer is still no greater than 10 per cent at most. We may decry the procrastination on the part of both patient and physician which delays the establishment of a diagnosis of cancer of the stomach, but we, as surgeons, must continually subject our technics to critical appraisal.

That many physicians failed in their responsibilities to patients with cancer of the stomach was suggested by the study of Warwick,⁵ who analyzed a large volume of post-mortem material and found cancer confined to the stomach and its environs in 23 per

cent of 176 patients at death. A recent study of secondary operations for recurrent gastric cancer⁶ emphasizes the fact that cancer of the stomach may remain localized to that organ and adjacent structures perhaps more frequently than is commonly recognized.

Coller, Kay, and MacIntyre,⁷ in their study of perigastric lymphatics, called attention to the shortcomings of surgical approach to this disease by demonstrating invasion of the duodenum by cancer in 26.4 per cent and extension of the disease to the proximal line of resection in 24.5 per cent of 53 cases. Verbrugghen⁸ demonstrated submucosal extension of the cancer at least 3 to 4 cm. beyond palpable tumor in tissues which were grossly normal.

Lahey,⁹ Longmire,¹⁰ Pack and Associates,¹¹ and Wangenstein¹² have referred to the inadequacies of subtotal gastrectomy as a procedure for the cure of gastric cancer. The first three have become increasingly strong advocates of total gastrectomy, while Wangenstein has recommended radical subtotal gastrectomy and a "second look" in all patients found to have metastases in perigastric lymph nodes after histologic study of the resected specimen.

It seems both logical and timely to support such clinical impressions by anatomical facts.

THESIS

Generally speaking, eradication of the primary growth so as to prevent subsequent local recurrence is the basic concept of successful therapy in the treatment of malignant tumors. Subsequent distant metastases probably prove that the tumor was beyond

* Read before the New York Surgical Society, February 8, 1950. Submitted for publication May, 1950.

the stage of control even when the initial treatment was administered. Local recurrence, however, must be interpreted as the result of inadequate therapy whatever its type and however administered.

In an evaluation, therefore, of subtotal gastrectomy as an operative procedure for the cure of cancer, the demonstration of a high incidence of local recurrence would indicate by this criterion that the procedure, at least as commonly practiced, is inadequately conceived and executed.

SOURCES OF MATERIAL

In Stout's review of the pathology of gastric carcinoma¹³ he discusses a group of eight patients* on whom autopsies were performed six or more months following subtotal gastrectomy. All but one of these eight patients had died of cancer. One had developed a new and independent cancer in the gastric remnant 23 years following resection. Three died with widespread metastases but no local neoplasm, and the remaining three died with local recurrence but no metastases.

Briefly stated, it has been our purpose to extend this observation of Stout and to determine whether local recurrence in gastric remnant, gastric bed, or duodenal stump is a common finding in survivors of subtotal gastrectomy who subsequently die of cancer. To obtain such data it was first necessary to review a large number of autopsy protocols of patients dying with gastric cancer and to select from this group for further analysis only those cases in which subtotal gastrectomy had been previously performed. All patients who had expired in the immediate postoperative period were rejected. The clinical charts of the group remaining then had to be consulted for such correlative detail as could be acquired. In particular, the description of the operative procedure was carefully studied in order to

determine whether the intent of the operating surgeon was curative or palliative. All patients who had been subjected to a palliative resection were rejected. In this manner a series of cases was obtained in which every patient had undergone a subtotal resection of the stomach for carcinoma, believed by the surgeon to be curative, and had died in an institution where autopsy was performed and findings recorded.

Obviously, this material could not be amassed in any one institution.† In most in-

† The following hospitals which co-operated in making all relevant autopsy protocols and clinical records available for complete study.

Bellevue Hospital	New York Hospital
City Hospital	Queens General
Columbia Presbyterian	Hospital
Medical Center	Roosevelt Hospital
Doctors Hospital	U. S. Marine Hospital,
Montefiore Hospital	Staten Island
New York City Cancer	Veterans Administration
Institute	Hospital, Bronx, N.Y.

Clinical data of cases procured from autopsy protocols of the above hospitals and operated upon elsewhere were obtained from the following hospitals:

Flower Fifth Avenue	Fordham Hospital
Hospital	Gouverneur Hospital
French Hospital	Lenox Hill Hospital
Harlem Hospital	Morrisania Hospital
Metropolitan Hospital	St. Johns Hospital,
Mount Sinai Hospital	Brooklyn

We particularly wish to thank the following for their friendly help in facilitating this study.

- Drs. Sigmund L. Wilens and John Hall of Bellevue Hospital
Dr. James R. Lisa, City Hospital and Doctors Hospital
Dr. H. P. Smith, Columbia Presbyterian Medical Center
Dr. Harry M. Zimmerman, Montefiore Hospital
Dr. Angelo M. Sala, New York Cancer Institute
Dr. John T. Ellis, New York Hospital
Dr. Alfred Angrist, Queens General Hospital
Drs. Walter Brandes, William C. White and Henry Cave, Roosevelt Hosp.
Drs. Arthur C. Allen and Edwin V. Olmstead, Veterans Administration Hospital, Bronx
Dr. George S. Cameron, U. S. Marine Hospital, Staten Island.

* These patients are believed included in the present series.

stances it was found that the patient's terminal hospitalization was in a different institution from that in which the original surgery had been performed. Consequently, the help of the Pathology Department, Clinical Record Department, and Clinical Staff of most of the larger hospitals in the greater New York area was solicited and most graciously extended. This courtesy is gratefully acknowledged.

In this manner, furthermore, the figures herein reported are believed to represent not the experience of any one hospital or any one particular surgical group but rather, a fair cross-section of the surgery commonly practiced in recent years throughout this entire metropolitan area.

ANALYSIS OF MATERIAL

One hundred and twenty autopsy protocols of operative survivors of subtotal gastrectomy were secured and reviewed. The clinical charts and operative notes of these patients were then sought and studied. The following analysis is based on 92 cases in which both the clinical and pathologic findings, although sometimes sketchy, were sufficiently documented for reasonably accurate appraisal. In the following paragraphs, the term *recurrence* is used consistently to indicate persistent cancer in the gastric remnant or duodenal stump.

Recurrence in Gastric Remnant. In 46 autopsies, or in 50 per cent of the 92 patients, there was local recurrence of the carcinoma either in the wall of the stomach or at the site of the gastro-enterostomy within a period varying from two to 75 months after subtotal gastrectomy. Extension to the esophagus from recurrence in the gastric wall was found in five instances.

Recurrence in the Duodenal Stump. There were 14 instances (15.2 per cent) of recurrence of cancer in the duodenum. Five of these were associated with recurrence in the gastric remnant and are included in that group, leaving 9 (9.8 per cent) in which

local recurrence was limited to the duodenal stump alone.

TABLE I.—Incidence of Failure in Local Control of Gastric Cancer; Autopsy Findings in 92 Survivors of Subtotal Gastrectomy.

Findings	Number	Percent
Grand total.....	92	100.0
Total failures in local control.....	74	80.5
Recurrence in gastric remnant....	46	50.0
Recurrence in duodenal stump....	9	9.8
Metastases in perigastric nodes and gastric bed.....	19	20.7
Distant metastases only.....	14	15.2
No recurrence or metastases.....	4	4.3

TABLE II.—Correlation of Data: Microscopic Pathology. Based on 92 Definitive Cases.

Histologic Type	No Local Recurrence		Local Recurrence	
	Number	Percent	Number	Percent
Total cases.....	18	100.0	74	100.0
Adenocarcinoma.....	11	61.1	48	64.9
Colloid carcinoma.....	1	5.6	9	12.2
Linitis plastica.....	1	5.6	3	4.1
Scirrhus carcinoma....	3	16.7	8	10.8
Carcinoma unclassified...	1	5.6	4	5.4
'Benign' gastric lesions..	1	5.6	2	2.7

Local Metastasis in Perigastric Lymph Nodes. It has been somewhat difficult to evaluate this finding in the material at hand. To differentiate a metastasis to the substance of the pancreas from a local recurrence in the stomach bed invading the pancreas, for instance, or to recognize the lymph node origin of a mass of cancer invading the liver from the gastrohepatic ligament, on the other hand, is difficult and often uncertain. Nevertheless, after careful study of the autopsy protocols in the 92 cases herein presented, it is believed that in 48 instances there was local metastasis in the perigastric lymph nodes and the stomach bed. There was associated recurrence of tumor in the gastric remnant or in the duodenum in 29 of these cases. In the remaining 19 (20.7 per cent) the local neoplastic process was confined to the remaining perigastric nodes and gastric bed.

Comment. It should be understood that in the majority of these cases at the time of autopsy there was evidence of distant metastases as well. Since all 92 patients were subjected to curative resections it is certain that distant metastases were not recognizable at the time of surgery, and it is difficult to disprove that these metastases in many cases did not derive from the local recurrence known to have occurred. There was local recurrence in the gastric remnant in 50.0 per cent, in the duodenal stump in an additional 9.8 per cent and local metastases in the perigastric nodes and stomach bed in an additional 20.7 per cent of cases. There was thus a failure to control the malignant process locally in 80.5 per cent of 92 cases (Table I).*

dividuals, the cases in this series were ana-gastrectomy might have to do with factors lyzed as to microscopic pathology, gross pathology, and extent of surgery performed. In addition, comparative survival times were determined to learn whether prognoses were materially influenced by the presence or absence of local recurrence.

Of the 92 cases in this series, 74 patients at autopsy showed findings interpreted as local recurrence or metastasis. Of the remaining 18 patients, 14 died of disseminated cancer without local recurrence and four died of unrelated causes with no evidence of cancer anywhere. Where locally recurrent cancer only is the problem in question, it is reasonable to combine the four cured cases with the 14 cases of disseminated cancer for the purpose of comparison, and this has been done in the following analysis. The two contrasting groups of 74 cases and 18 cases respectively are numerically not comparable, and the percentages listed in the accompanying tables are intended to indicate only relative distribution rather than statistically accurate fact.

Microscopic Pathology. (Table II). The predominance of adenocarcinoma as the histologic diagnosis in both series is consistent with clinical experience. The general distribution of other types of carcinoma in both series suggests that there was no significant difference in histologic type of cancer in either group. It is of interest to note that by subtotal resection local control of the tumor was accomplished in one of ten cases of colloid carcinoma and in one of four cases of linitis plastica. From the natural life history of both of these notoriously aggressive tumors it is somewhat surprising that there were any instances of local control by subtotal gastrectomy. The original diagnosis in two cases was benign peptic ulcer and in one was hypertrophic gastritis, but the subsequent course of events in all three indicates that the primary gastric cancer was probably missed in the sections studied.

TABLE III.—Correlation of Data: Gross Pathology. Based on 62 Definitive Cases.

Gross Pathology	No Local Recurrence		Local Recurrence	
	Number	Percent	Number	Percent
Total cases	17	100.0	45	100.0
Ulcerating carcinoma	11	64.7	23	51.1
Infiltrating carcinoma	4	23.5	17	37.8
Polypoid carcinoma	2	11.8	5	11.1

TABLE IV.—Correlation of Data: Size of Primary Lesion. Based on 60 Definitive Cases.

Size of Lesion	No Local Recurrence		Local Recurrence	
	Number	Percent	Number	Percent
Total cases	17	100.0	43	100.0
Under 3 cm.	3	17.6	5	11.6
3 cm.-5 cm.	8	47.6	17	39.5
Over 5 cm.	5	29.4	15	34.9
"Diffuse"	1	5.9	6	14.0

CORRELATION OF DATA

To determine whether this high incidence of local recurrence following subtotal peculiar to the tumor in these particular in-

* As an outgrowth of the present report, an anatomical study of cleared surgical specimens consisting of the entire stomach; greater omentum, spleen and body and tail of the pancreas is now in progress at Memorial Hospital. *Unsuspected* foci of metastatic cancer are being found in the splenic pedicle and tail of the pancreas in about 50 per cent of the specimens.

Gross Pathology. (Table III). The gross characteristics of the primary tumor were not recorded in 30 cases. The findings in the remaining 62 cases are used for comparison. In each group, ulcerating cancer was found to be the most common gross type, infiltrating cancer the next most common, and polypoid cancer the least common.

As to the size of the primary lesion (Table IV), figures are available in 60 cases which have been used for comparison. In each group, lesions measuring 3 to 5 cm. in greatest diameter were most frequently encountered. Of particular interest is the fact that of eight patients having primary lesions less than 3 cm. in diameter, there were five who developed local recurrence following subtotal gastrectomy. One might have anticipated that subtotal gastrectomy would have prevented local recurrence in patients with these small tumors.

Extent of Surgery Performed. It is difficult to determine accurately the amount of stomach removed in each of the cases herein analyzed. It would be desirable to know in each specimen the measurements of the free margins proximal and distal to the tumor. This information was provided in so few cases as to make conclusions impossible. Consequently, the less accurate estimation by surgeon or pathologist of the amount of stomach resected has been employed for this analysis. Sixty cases provided such an estimated value (Table V). It is of interest to note that only three of these 60 patients had more than a 75 per cent resection, but two of these showed local recurrence.

Relative Survival. (Table VI). Four of the 92 patients in this series died of unrelated causes free of cancer, as proved by autopsy. Of the remaining 88 patients, all of whom died of cancer, the average survival from the time of subtotal gastrectomy to death was 20.3 months. For the 74 patients having locally recurrent cancer, the average survival time was 20.6 months, and for the 14 patients with distant metastases

the average survival time was 18.9 months. When gastric cancer is not cured, therefore, the presence or absence of local recurrence has little apparent effect on the average survival time.

CRITIQUE

This study represents an investigation into the causes of failure in our treatment of cancer of the stomach. Since we know neither the cause of the disease nor its intrinsic potentialities for growth restraint or activity, our remarks must be confined to an evaluation of our surgical treatment.

The fact that the patients herein reported all represent resection survivors indicates that the operating surgeons were well trained in the performance of gastric operations. This material was obtained from

TABLE V.—Correlation of Data: Extent of Resection. Based on 60 Definitive Cases.

Extent of Resection	No Local Recurrence		Local Recurrence	
	Number	Percent	Number	Percent
Total cases.....	16	100.0	44	100.0
Less than one-half.....	4	25.0	7	15.9
One-half resection.....	4	25.0	15	34.1
One-half to three-fourths..	7	43.8	20	45.5
More than three-fourths..	1	6.3	2	4.5

TABLE VI.—Average Survival Time of Patients Subjected to Subtotal Gastrectomy for Cancer. Based on 88 Patients Dying of Recurrence or Metastases*

	Number of Cases	Average Survival in Months	
		Number	Percent
Grand total.....	88		20.3
Total local recurrence and local metastases.....	74		20.6
Recurrence in gastric remnant....	46	22.0	
Recurrence in duodenum.....	9	13.0	
Metastases in perigastric nodes or gastric bed.....	19	20.9	
Distant metastases only.....	14		18.9

* Four of the 92 patients died of unrelated causes free of disease.

many of the leading hospitals in New York City, providing a fair cross-section of the experience of a large metropolitan area. Inasmuch as gastric resection in most institutions has been performed by senior surgeons or under their direction, these surgical fail-

ures cannot be explained on the basis of inexperience.

It has been shown that neither the size nor the histologic type of a given lesion is any guarantee against local recurrence. It is evident that the extent of resection in many instances was a matter of individual judgment rather than a matter of standardized procedure.

It is believed that many surgeons who perform subtotal gastrectomy for duodenal ulcer apply erroneously the same technic to the treatment of gastric cancer. The high incidence of metastasis to the regional perigastric lymph nodes and omentum demands that these tissues be included in the dissection. The operation, as generally practiced, appears not to have been directed toward a generous removal of the primary tumor as well as its lymph node drainage area if in 59.8 per cent of instances there were recurrence in the gastric remnant or duodenum, and in an additional 20.7 per cent there were regional lymph node metastases found at necropsy. Again the fact must be emphasized that control of the primary tumor and its adjacent lymph node drainage area is a fundamental concept in the treatment of cancer, whatever its anatomical site.

If one assumes a 30 per cent five-year salvage in survivors of subtotal gastric resection¹⁻⁴ for cancer, the cases herein analyzed fall in the remaining 70 per cent group. Since local recurrence of carcinoma was found in 80.5 per cent of this series, one may assume local recurrence occurred in 56 per cent of the total group of resection survivors. Since one cannot disprove that the subsequent dissemination of cancer did not result from the local recurrence in this 56 per cent group, one must assume that about half of the patients surviving subtotal gastrectomy may have been denied a chance of cure because of inadequate surgery.

CONCLUSIONS

1. Subtotal gastrectomy for the cure of cancer, as commonly practiced in the past,

may have denied the chance for cure to about half the operative survivors because of the development of recurrence in the gastric remnant, duodenal stump, perigastric lymph nodes, or stomach bed.

2. To lessen this possibility of failure in the future, two alternative courses seem indicated: (a) standardization of the procedure of radical subtotal gastrectomy for cancer; or (b) routine employment of total gastrectomy for *all* operable gastric cancers by experienced surgeons.

3. Total gastrectomy would seem the most logical operation for the treatment of gastric cancer in the light of these findings.

BIBLIOGRAPHY

- 1 Walters, W., H. K. Gray and J. T. Priestley: Prognosis and End Results in the Treatment of Cancer of the Stomach. *Arch. Surg.*, **46**: 939, 1943.
- 2 Lahey, F. H.: Personal Communication.
- 3 Welch, C. E., and A. W. Allen: Carcinoma of the Stomach. *New England J. Med.*, **238**: 538, 1948.
- 4 Pack, G. T., and G. McNeer: End Results in the Treatment of Cancer of the Stomach. *Surgery*, **24**: 769, 1948.
- 5 Warwick, Margaret. Analysis of 176 Cases of Carcinoma of the Stomach Submitted to Autopsy. *Ann. Surg.*, **88**: 216, 1928.
- 6 McNeer, G., R. J. Booher and L. Bowden: The Resectability of Recurrent Gastric Carcinoma. *Cancer*, **3**: 43, 1950.
- 7 Coller, F. A., E. B. Kay and R. S. MacIntyre: Regional Lymphatic Metastases of Carcinoma of the Stomach. *Arch. Surg.*, **43**: 748, 1941.
- 8 Verbrugghen, Adrien: Intramural Extension of Gastric Carcinoma. *Arch. Surg.*, **28**: 566, 1934.
- 9 Lahey, F. H.: Total Gastrectomy for All Patients with Operable Cancer of the Stomach. *Surg., Gynec. & Obst.*, **90**: 246, 1950.
- 10 Longmire, W. P.: Total Gastrectomy for Carcinoma of the Stomach. *Surg., Gynec. & Obst.*, **84**: 21, 1947.
- 11 Pack, G. T., G. McNeer and R. J. Booher: Principles Governing Total Gastrectomy. *Arch. Surg.*, **55**: 457, 1947.
- 12 Wangenstein, O. H.: Personal Communication.
- 13 Stout, A. P.: Pathology of Carcinoma of the Stomach. *Arch. Surg.*, **46**: 807, 1943.