

# Implantation of Gastric Cancer in Abdominal Wounds \*

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ONE MANIFESTATION of surgical failure in the treatment of gastric cancer is subsequent growth of the tumor in the abdominal wall incision. Presumably, this occurs when neoplastic cells are inadvertently spilled during the operation. Recently, attention has centered on the ease with which cancers of the large intestine, breast, ovary, head and neck regions are surgically implanted. Since little consideration has been given to this problem as it pertains to gastric cancer, it seemed desirable to study wound recurrence in a series of patients subjected to gastrectomy. This has naturally led to an examination of mechanisms by which cancer cells may be transplanted to the operative wound.

## Materials and Methods

For this study, a review was made of the records of all patients from the Gastric Service (Memorial Center, New York) who were subjected to definitive ("curative") gastrectomy for cancer. There were 607 such operations performed during the 28-year-period, 1931 through 1957. Adequate follow up data on the status of the wound were available on 569 patients. Nonresectable cases and palliative operations were not included in this analysis. The records of all patients in whom a mass in the wound was reported were studied to assess the significance of this finding.

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## Results

**Incidence.** The records of 11 of the 569 patients (1.9%) had a mass described in the abdominal incisional area. Of these, nine were considered instances of recurrent gastric cancer in the wound although histologic study was done in only five. One of the 11 patients had a desmoid tumor. Nodularity in the wound was frequently noted but this was generally attributed to a suture granuloma or other inflammatory process. In only one of the 11 patients was the inflammation such as to present a clinical diagnostic problem. The incidence of abdominal wall recurrence was not affected by the type of gastrectomy performed (Table 1). It is of interest that all patients with recurrent cancer in the wound were men, although the desmoid tumor and the inflammatory mass occurred in women.

**Latent Period.** Incisional recurrent cancer was first noted from 2.5 months to 38 months after the gastrectomy (Table 2). The desmoid tumor was first apparent 16 months after operation and the inflammatory mass which seemed clinically to be neoplastic was found 37 months after a total gastrectomy.

**Primary Cancer.** The gastric tumor in all cases was an extensive, ulcerating adenocarcinoma. Seven of the patients with wound recurrence had serosal invasion by cancer. Four patients had metastases to regional lymph nodes. In nearly all cases, the gross extent of gastric involvement by cancer was so great that the margins of resections were described as "close" but in no instance was tumor

TABLE 1. *Incidence of Wound Recurrence After Gastrectomy for Cancer*

Type of Gastrectomy	No. of Patients	No. with Wound Recurrence	%
Total	177	2	1.1
Distal subtotal	313	6	1.9
Proximal subtotal (cardiectomy)	79	1	1.3
All cases	569	9	1.5

actually transected. A biopsy prior to resection was not performed in any of the cases.

Broder's classification of the primary neoplasm ranged from Grades II to IV with six lesions falling in Grades III or IV.

An incisional tumor was the first objective evidence of recurrent gastric cancer in four of the nine cases. In three patients, other sites of disease were noted concurrently with the abdominal wall disease. This information was not available in two instances.

**Clinical Appearance.** Typically, the abdominal wall recurrence was described as a firm, moveable, nontender nodule in the subcutaneous tissue with attachment to the overlying skin. The mass measured two to three cm. and involved only one portion of the scar (Fig. 1, 2). In some instances, the initial manifestation of an incisional tumor was noted to be only a slight thickening in the scar. In time, it progressed to a nodular or ulcerating mass. Figure 3 shows the appearance of an advanced, ulcerating abdominal wall recurrence.

Histologic study of the wound recurrence was made in five of the nine cases. The clinical appearance and subsequent course of events in the other four instances were so characteristic of recurrent cancer that the cases could be accepted without reservation.

**Treatment.** The incisional recurrence was excised in three patients. In one instance, this consisted of a limited extraperitoneal resection of the abdominal wall. In a second patient, the wound recurrence was widely excised with a segment of adherent transverse colon. At laparotomy, no other gross evidence of cancer was found although the lesion had been present clinically for 16 months. The third patient was initially given radiation therapy consisting of 3,000 r. tumor dose over a 21-day-period (250 KV.). Following this, the mass was implanted with six gold radon seeds at 1.26 millicuries each. Regression was minimal and the mass was subsequently excised. By this time, the development of metastases in the left axillary region necessitated a concurrent axillary dissection. Radiation

TABLE 2. *Recurrent Gastric Cancer In Wound*

Case	Interval Between Gastrectomy and Wound Recur.	Survival After Wound Recur. Noted
J. B.	2.5 mos.	15 mos.
J. A.	3 mos.	28 mos.
E. D.	3.8 mos.	2 mos.
J. F.	4 mos.	4 mos.
S. H.	5 mos.	2 mos.
H. H.	11 mos.	3 mos.
S. X.	22 mos.	3 weeks
E. F.	24 mos.	17 mos.
A. Z.	38 mos.	6 mos.

FIG. 1. Appearance of recurrent gastric cancer in the abdominal wound. A total gastrectomy had been performed two years before this mass was noted (Case E.F.).



therapy alone was given to two patients. In one tumor there was moderate regression. The effect on the implant was not recorded in the other. Four patients had no treatment to the abdominal wall mass. Both the desmoid and the inflammatory mass which presented a diagnostic problem were excised after several months of observation.

**End Results.** All nine patients with recurrent gastric cancer in the operative wound died of abdominal carcinomatosis from three weeks to 28 months after the recurrence was first noted. The patient with a desmoid tumor has survived 17 months since her second operation without evidence of disease. The patient with an inflammatory nodule died of liver metastases five years after its excision and eight years after total gastrectomy.

### Discussion

The findings in this study indicate that any abnormal thickening or nodularity in the wound following a gastrectomy for cancer should be studied histologically. Most clinically significant tumors will be recurrent cancer and for patients so af-

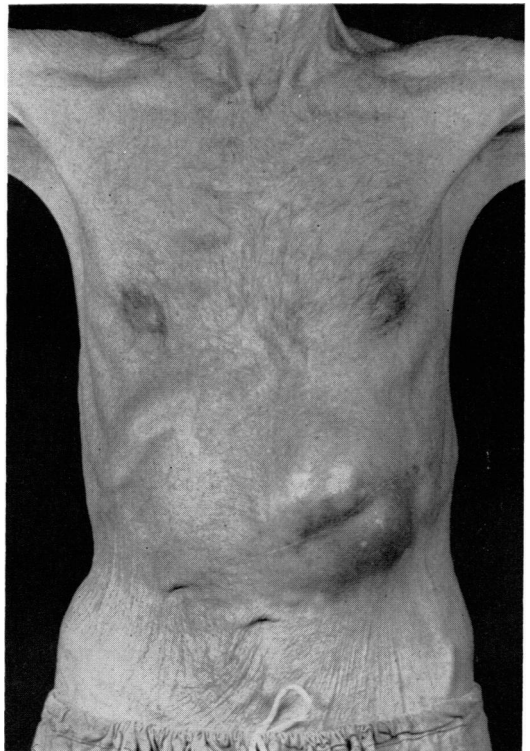


FIG. 2. Wound recurrence in Case J.A. after a 16 month period of observation (operation refused). Photograph taken when tumor was still grossly confined to the incisional area and adjacent colon.



FIG. 3. Ulcerating recurrent gastric cancer (this woman received her primary treatment elsewhere and was therefore not included in this series).

flicted, the prognosis is poor. In some cases, however, excision of the recurrence with long-term survival is possible. Ackerman and Wheat<sup>1</sup> have reported a patient who was alive and without evidence of disease four years after resection of a gastric cancer which had recurred in the abdominal scar. Case J.A., in our series, refused excision of a recurrence for 16 months. At operation, the cancer was still grossly confined to the incision and adjacent transverse colon which suggests that earlier operative intervention might have been curative. In other cases, a different tumor, originating primarily in the abdominal wall, may have fortuitously developed. Also, an inflammatory process, clinically indistinguishable from a neoplasm, can be present. Cronin and Ellis<sup>6</sup> have noted a similar variability in the

operative findings of 31 patients who were suspected of having recurrent cancer in the wound. Although their series is largely composed of cases of large bowel cancer, two thirds of the patients had nonmalignant conditions or a resectable recurrence. One of the latter was a recurrent gastric cancer.

Authors reporting on the implantation of gastric cancer have attributed wound recurrence to spillage of cancer cells during the operative procedure.<sup>1, 2, 6, 9, 10, 12</sup> The means by which this contamination occurred has not been delineated in many instances. In our patients, gastric resection was carried out on the basis of clinical and operative findings without preliminary biopsy. The primary cancers were extensive but there was no evidence on pathological study that tumor was transected either grossly or microscopically. Gastrectomy was performed by standard operative methods which apparently failed to prevent cancer cells from being liberated into the operative wound and peritoneal cavity.

Malignant cells have been found in wounds after operation for a variety of primary operable cancers. Smith, Thomas and Hilberg<sup>15</sup> reported cancer cells in the washings of 25.9 per cent of 120 operative procedures. Numerous explanations have been presented to explain the findings. Among these, Pomeranz and Garlock<sup>13</sup> suggested that tumor cells might be spilled in colonic cancer cases when operative manipulations wipe off the protective but friable serosa covering subserosal cancer cells. This concept seems applicable to gastric cancer particularly since the primary tumor in seven of our nine cases had local serosal involvement. Quan<sup>14</sup> indicated that cancer cells are present in the peritoneal cavity prior to resection in some patients with large bowel cancer who are considered to have potentially curable lesions.

An alternative explanation for the contamination of some operative wounds by cancer cells is feasible. Neoplastic cells

are found in washings obtained from the surface of nearly all ulcerated, mucous membrane cancers<sup>16</sup> and most gastric cancers are ulcerated. Cytologic examination of preoperative gastric aspirates frequently reveals malignant cells.<sup>17</sup> It therefore seems probable that violation of the intactness of the stomach or adjacent portions of duodenum and esophagus carries a grave risk of spillage of cancer cells even in the absence of gross contamination. Furthermore, isolation of the operative site with laparotomy pads and even use of cautery for transection of the duodenum are unlikely to completely prevent this catastrophe. Theoretically, the escape of a single cancer cell onto an area with satisfactory conditions for growth is all that is necessary for cancer to recur.

The danger of intraluminal "free" cancer cells has been recognized particularly in cases of colon cancer. Various measures have been suggested to prevent local recurrence resulting from this factor.<sup>3-5, 7, 8, 11</sup> Cole<sup>3, 4</sup> suggested that ligatures be placed several inches above and below colon tumors prior to manipulation of the primary cancer. He also suggested irrigation of both ends of the bowel with distilled water after resection of the tumor bearing segment. Goligher, Dukes, and Bussey<sup>7</sup> used 1:500 solution of perchloride of mercury to irrigate the distal segment of bowel. Haverback and Smith<sup>8</sup> in reviewing the problem of tumor seeding presented clinical and experimental evidence that tumor can be transplanted by sutures which carry free cancer cells into the anastomotic site.

Cancer contamination of operative sites, both intraperitoneally and extraperitoneally, would seem most effectively prevented by destroying all viable, free cancer cells in the lumen before opening the gastrointestinal tract. This might be accomplished with chemotherapeutic agents which are locally effective. At the time of resection for gastric cancer, the substance could be administered via a Levine tube after

clamping off the duodenum and major blood supply of the stomach. Use of an aseptic technic for duodenal closure and for the anastomoses might further minimize the danger of spillage. These precautions may not only prevent wound recurrence but also significantly reduce intraperitoneal spread and thereby improve the survival rate for gastric cancer.

### Summary

Wound recurrence of gastric cancer was described in nine (1.5%) of 569 patients who were subjected to a "curative" gastrectomy. A desmoid tumor and a clinically confusing inflammatory lesion were also present in this series. The prognosis in patients with incisional recurrence is grave as evidenced by the lack of success in the five patients in whom treatment measures were instituted. Possible etiological factors producing this finding are discussed and preventive measures proposed.

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