

## —Reviews—

## It's what the surgeon doesn't see that kills the patient

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**Abstract**

Peritoneal dissemination can be prevented by the responsible surgeon at least in part by proper surgical technique used to resect the primary malignancy. What most people do not know is that cancer surgery can do great harm. It can convert a contained malignant condition into a disseminated disease that unnecessarily becomes a deadly process. Containment must be the number one priority of the gastrointestinal cancer surgery. Also, established peritoneal carcinomatosis can be cured if it is attacked in a timely fashion with peritonectomy procedures and heated intraoperative intraperitoneal chemotherapy. Many small changes can make a big difference in survival with gastrointestinal cancer surgery. (J Nippon Med Sch 2000; 67: 5—8)

**Key words:** gastric cancer, colon cancer, peritoneal carcinomatosis, intraperitoneal chemotherapy, surgical skill

**Introduction**

Oncologists accept that the prognosis of a patient with cancer is largely dependent upon two factors. First, the *aggressive nature* of the neoplasm is of paramount importance. If the cancer is of an invasive type, the prognosis is diminished. If it is non-invasive but rather expands by pushing into the surrounding tissues, the prognosis may be very good even though the cancer is large.

Also, the *stage* of the malignancy at the time of diagnosis is of paramount importance. If the cancer has progressed so that the lymph nodes are involved or blood-borne metastases have occurred, the prognosis is reduced. If distant metastases are present before treatments are initiated, the situation may be hopeless.

Granted, the aggressive nature and the stage of the cancer are important. However, for gastrointestinal malignancy there may be an even more crucial factor in regards to prognosis. This is the *technical skill* of the responsible surgeon. The grim reality is that the difference in survivorship obtained by the best and the

worst gastrointestinal cancer surgeons is at least 50 % ! This concept of cancer prognosis has not been adequately explored in recent years.

**1. Data from the surgical literature**

The concept that surgical skill is a crucial prognostic factor is not new. In 1967, Turnbull and colleagues from the Cleveland Clinic in Ohio, published a manuscript presented at the American Surgical Society on "No-touch isolation techniques". They were convinced that the surgeon's gentle handling of tissues would prevent dissemination of cancer cells through the portal system to the liver<sup>1</sup>. Turnbull's statistical evaluation of his data may not be acceptable by present day standards; also his hypothesis regarding the mechanism of cancer dissemination is not compatible with current data regarding the natural history of gastrointestinal cancer. However, it remains clear that his published results with the surgical treatment of colorectal cancer obtained by no-touch techniques were far superior to other reports in the 1960s. From England, Phillips and colleagues called attention to the marked variation in the incidence of local recurrence of rectal can-

cer when the statistics for individual surgeons were tabulated. These data published in the British Journal of Surgery clearly established their opinion regarding surgical skill and its effect on local cancer recurrence<sup>2</sup>. There has always been a marked difference in survival in patients with or without local recurrence of rectal cancer.

I described numerous technical factors which will influence survival in colon and rectal cancer surgery in a monograph in 1981<sup>3</sup>. The components of an adequate colon or rectal cancer resection were explicitly laid out. Again, in 1995, our opinions regarding surgical technique and its impact on local recurrence and survival were summarized<sup>4</sup>. Hermanek and colleagues in a landmark publication courageously documented the great differences in local recurrence rates of individual surgeons. These authors documented the incidence of local recurrence as high as 55% and as low as 5%<sup>5</sup>. As expected, the survival was directly correlated with the rate of local recurrence. One surgeon had a five-year survival rate as low as 35% and other surgeons had survival rates as high as 85%. This manuscript looked for risk factors that would account for the marked differences in local recurrence and survival. The stage of the malignancy and clinical factors involved in its presentation did not seem to explain these great differences. Rather, the surgical skill possessed by the responsible surgeon was the overwhelming prognostic variable.

Recently, Porter and colleagues from Alberta, Canada reported in the Annals of Surgery on the differences in local recurrence and survival for rectal cancer between two groups of surgeons<sup>6</sup>. One group had advanced training and greater experience in the operating room. The other group had no special training and performed rectal cancer surgery on an occasional basis. In the experienced and high volume group, the overall survival was 67%. The occasional surgeon without additional training could only produce a 35% survival.

## 2. Dissemination of gastrointestinal cancer

We know that gastrointestinal cancer disseminates in three ways. It can metastasize via the portal bloodstream to the liver. It may be difficult or impossible for the surgeon to reduce the incidence of metastases

within the liver. Unless the surgeon is extremely rough it is unlikely that he will squeeze cancer cells into the portal blood, although, theoretically this is possible. Gastrointestinal cancer also spreads to lymph nodes and may disseminate to peritoneal surfaces. If patients recur with lymph node involvement or with progressive disease at the resection site or on peritoneal surfaces, this is the surgeon's responsibility. Recurrent disease at either of these two sites indicates insufficient skill of the responsible surgeon.

The hideous flaw that exists with inadequate gastrointestinal cancer surgery can be formulated as follows. Many patients come to the surgeon with a contained malignancy. It may be advanced and beginning to disseminate local-regionally; however, as yet there is no spread of the cancer. Unfortunately, in a large proportion of gastrointestinal cancer operations, with unskillful resection the patient leaves the operating room with persistent cancer in lymph nodes or with a disseminated malignancy on the internal lining of the abdomen for which there can be no cure. This hideous flaw, inadequate surgical skill, is not currently anticipated by those who must undergo gastrointestinal cancer resection. Unfortunately it is very possible that they will die, not because their cancer was aggressive or was at a late stage; but because the responsible surgeon lacked knowledge and/or skill.

## 3. Containment through centripetal surgery

What are the essential components of adequate gastrointestinal cancer surgery? These can be listed as follows: Wide exposure of the operative field, absolute hemostasis using lasermode electrosurgery, adequate lateral margins of dissection, adequate lymph node dissection, and knowledgeable use of perioperative intraperitoneal chemotherapy<sup>7</sup>. If the surgeon is to perform surgery optimally, he must clearly visualize the primary cancer. There should never be a struggle for adequate visualization of the cancer or of the surrounding abdominal or pelvic viscera. The procedural dictum for adequate containment of the gastrointestinal surgery is called CENTRIPETAL SURGERY. In this approach to cancer resection one must move around the tumor mass with 1) perfect hemostasis, 2) adequate margins of dissection, and 3) sufficient visualization so that vital structures are not damaged. If

all of these requirements are not met, the surgeon must attack the malignant disease from another anatomic site.

#### 4. Requirement for intraperitoneal chemotherapy

No matter how skillful the surgeon has become or how meticulous he is in his dissection, in some patients there will be intraoperative cancer spill. In this situation, perioperative intraperitoneal chemotherapy must be used. This is the first indication for this technique listed in **Table 1**. The surgeon should employ heated intraoperative intraperitoneal chemotherapy using mitomycin C for the gastrointestinal adenocarcinomas. The skin is tented up on a self-retaining retractor. Chemotherapy is maintained at 43°C within the peritoneal cavity. The peritoneal perfusion must be carried on for at least an hour. During the intraabdominal treatment, all of the intestines and other intraabdominal structures are continuously manipulated by the surgeon. All residual blood clots and tissue debris must be washed away by the surgeon's hand because they are the fibrin matrix in which cancer cells progress (**Fig. 1**).

There are other absolute indications for heated intraoperative intraperitoneal chemotherapy. If the surgeon removes lymph nodes containing cancer and these nodes are at the limits of the dissection, he must assume that cancer cells will be released unavoidably into the free peritoneal cavity. These spilled cancer cells will eventually cause the patient's death. Intraperitoneal chemotherapy has been shown to be of benefit to gastric cancer patients with involved lymph nodes at the limits of dissection<sup>9</sup>.

Similarly, if in removing a malignancy exposed cancer tissue is seen at the margin of dissection, there is an extreme likelihood of contamination of the resection site. A chemotherapy wash of the peritoneal surfaces is necessary.

When the surgeon collects fluid from the abdominal or pelvic cavity, that fluid can be studied microscopically. If cancer cells are seen then there is a positive peritoneal cytology. This patient is at extreme risk for cancer progression on abdominal or pelvic surfaces. This patient should have an intraperitoneal chemotherapy wash to eliminate microscopic residual dis-

Table 1 Absolute indications for the use of heated intraoperative intraperitoneal chemotherapy in gastrointestinal cancer patients

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| 1. Intraoperative cancer spill                                    |
| 2. Gross involvement of lymph nodes at the margin of resection    |
| 3. Positive margins of resection                                  |
| 4. Perforated cancer  |
| 5. Biopsy confirmed peritoneal seeding                            |
| 6. Ovarian involvement  |
| 7. Invasion of adjacent organs and structures                     |
| 8. Peritoneal seeding with a peritoneal cancer index of $\leq 10$ |



Fig. 1 Technique for heated intraoperative intraperitoneal chemotherapy using the Coliseum Technique. After the surgeon completes the cancer resection and the peritonectomy procedures, the skin of the abdominal wall is suspended from a self-retaining retractor using a running suture. A plastic sheet is incorporated in this suture to cover the abdomen. A slit is made in the middle of the plastic to allow the surgeon's hand access to the abdominal and pelvic space. A smoke vacuum is placed beneath the plastic sheet to remove chemotherapy aerosols. Four drains and a single inflow catheter allow the chemotherapy solution to be recirculated through a heat exchanger. The fluid is maintained at approximately 42°C ; manual distribution of the chemotherapy solution ensures that heat and cytotoxic drug does not miss even one mm<sup>2</sup> of peritoneal surface.

ease.

If a gastrointestinal cancer perforates through the wall of the stomach or intestine, cancer cells have free access to the peritoneal surfaces. If the cancer cells have established cancer nodules within the ovaries, this proves that there has been peritoneal cancer contamination. Likewise, if the cancer has grown all the way through the stomach or intestine to invade an adjacent organ or structure, peritoneal cancer contamination must be assumed.

Finally, in some instances, biopsy confirmed peritoneal seeding must be treated. In these patients the selection factors for a palliative approach (debulking) as opposed to a curative approach (cytoreduction) have been clearly identified<sup>10</sup>. Peritoneal seeding of limited distribution and limited mass should be curable in approximately 40% of gastrointestinal cancer patients if a combined treatment plan of peritonectomy procedures and perioperative intraperitoneal chemotherapy are used.

##### **5. Not only the primary cancer but also microscopic residual disease**

How must surgeons change their attitude toward resection of gastrointestinal cancer? The surgeon must consider himself responsible not only for resection of the large mass of primary cancer, but also for dealing with MICROSCOPIC RESIDUAL DISEASE. Sometimes he does this by using centripetal surgery to prevent the spread of cancer cells. At other times he does it by preventing or treating carcinomatosis using peritonectomy procedures combined with peritoneal perfusion using a chemotherapy solution.

There are some important consequences of this view of surgical skill and cancer survivorship. Obviously, if there are such widely divergent results, then some surgeons are doing it wrong. Surgeons must demonstrate their expertise by maintaining a personal account of their successes and failures. Surgeons who have a high local recurrence rates and poor survival rates must be eliminated from the credentialed group. Patients with gastrointestinal cancer must be protected from needless death.

Acceptance of this concept means that approximately 30% of gastric cancer patients and 10% of colon cancer patients who present with a primary can-

cer with peritoneal seeding should be treated in specialized centers where the surgeons are familiar with peritonectomy procedures and intraoperative intraperitoneal chemotherapy treatment is readily available. The results of treatment of peritoneal carcinomatosis are far superior when the primary tumor and the involved peritoneum are removed simultaneously<sup>10,11</sup>. At the same operative setting, chemotherapy should be used to eliminate microscopic residual disease from the cancer resection site and from other places on the peritoneal surface. If the primary cancer cells with peritoneal seeding is resected in the absence of a chemotherapy wash, the cancer cells on the peritoneal surface will be implanted deep within the tissues and will be difficult, if not impossible to eradicate.

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