

CONFERENCIAS

PREOPERATIVE  
AND OPERATIVE TREATMENT  
OF PATIENTS WITH CANCER OF THE COLON

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The morbidity and mortality associated with operations for cancers of the colon have been materially reduced over the past fifty years. This reduction is attributable to a better understanding of the biological behavior of the disease, the physiological effects of obstruction, dehydration and malnutrition, fluid and electrolyte balance, and the use of whole blood transfusions, antibiotics, and decompression procedures, combined with better anesthesia and improved surgical techniques. Despite these advancements, the over-all prognosis associated with cancer of the colon during the past two decades has been only slightly improved, if at all. With the use of cancer therapy as it exists today, it is doubtful that surgeons can effect any dramatic change in five-year survival rates of patients with this disease.

In order to improve the outlook of patients with cancer of the colon, the surgeon must first realize that the most important therapeutic weapon is earlier diagnosis. The fact that many of these patients do not have symptoms until the disease becomes advanced is indeed discouraging. The surgeon, however, can continue to strive to educate patients concerning the necessity for seeking medical attention for early symptoms associated with cancers of the colon. Also, the physician can be more prompt in making sigmoidoscopic examinations and barium enema studies in the presence of symptoms which even conceivably could be related to early cancer. Second, the surgeon can strive to reduce the morbidity and mortality associated with operations for cancers of the colon by more thorough preoperative studies and preparation. Third, he can make every effort to gain local

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and regional control of the cancer. Below are described the preparatory measures as well as the surgical techniques employed in our hospital for carcinoma of the colon. We are convinced that rigid observance of these procedures will lead to a significant reduction of local and regional recurrences of colonic cancer.

## PREOPERATIVE EVALUATION AND TREATMENT

All these patients, particularly the elderly, should be questioned with respect to any cardiac, pulmonary or renal disorders. Every patient, also, should have an electrocardiogram, radiograms of the chest, and routine urinalysis, blood urea nitrogen and liver function studies. The surgeon must concern himself specifically with the presence of anemia and the nutritional status of the patient. For the majority of patients, correction of anemia, which is relatively common, carries priority. Hemoglobin and hematocrit determinations usually indicate whether transfusions of whole blood are indicated; preferably, the patient should have a preoperative hemoglobin level of 11 or 12 mg. For the elderly patient with a long history of anorexia and weight loss, with or without a history of significant intestinal bleeding, blood volume studies should be carried out. This is specially true of older patients who are hypertensive and have been taking antihypertensive medication; they tolerate the stress of anesthesia poorly and, for this reason, their blood volume should be restored to normal levels preoperatively. With respect to nutrition, many patients report a loss of weight, although relatively few are seriously malnourished; for these few, however, prolonged, intensive preoperative care is indicated. They should be placed on high calorie, high protein, high carbohydrate diets, and when possible should be given supplementary feedings between meals. The use of whole blood, plasma or amino acids is often indicated. Vitamins rich in B-complex and C are given, as well as intramuscular injections of vitamin K.

Although patients with cardiac, renal or pulmonary disorders, diabetes, or severe malnutrition require special consideration and often prolonged preoperative care, the average patient with cancer of the colon is admitted to our hospital three days before the operation. This affords ample time for preparation of the bowel. Despite arguments against their usage, we believe that, for the majority of patients, the use of a cathartic and enemas is the most satisfactory method of cleansing the bowel.

For this reason, the average patient is given 30 to 60 c.c. of castor oil 48 hours before the operation, as well as cleansing enemas twice daily. Since these procedures often are accompanied by varying degrees of dehydration, 1000 c.c. of dextrose in saline with 40 meq. of potassium is administered intravenously each day of preparation. A plain film of the abdomen is obtained the night before the operation. On numerous occasions, even though mechanical cleansing of the colon was believed to be adequate this scout film has revealed fecal impactions proximal to the lesion, necessitating postponement of the surgical procedure.

In our opinion, antibiotic therapy in the preoperative care of patients with cancer of the colon is one measure that has been responsible for reducing the morbidity associated with surgical treatment. Its use, however, has sometimes been followed by an undesirable and dangerous complication, namely, enterocolitis. As a consequence, the advisability of routine administration of antibiotic drugs, either preoperatively or postoperatively, is controversial. Nevertheless, our patients receive Neomycin, 1 gm., every six hours, beginning 48 hours before operation. Unless the surgical wound has been contaminated by spillage, no antibiotic therapy is administered postoperatively.

#### MODES OF EXTENSION AND CONSIDERATIONS IN TREATMENT

A better understanding of the biologic behavior of cancer in general and the methods of spread of colonic cancers in particular offers new avenues of clinical investigation. These, in turn, may lead to an improvement of the survival rates of patients with this disease. More important, this knowledge has already contributed to a material reduction of local and regional recurrences.

##### *Direct Extension*

More than three-fourths of all cancers of the colon have penetrated the entire wall by the time the diagnosis is established (4). According to investigations by numerous authors, intramural invasion usually does not extend more than 2 cm proximally and distally from the margin of the tumor. Most of their studies, however, have been carried out on formalin-fixed specimens (15, 16, 22). The amount of contraction of the tissues from the living state to the formalin-fixed state is often overlooked or not fully appreciated by the surgeon. This contraction

is especially significant if the tumor is located in the rectosigmoid. We do not perform anterior resections as curative operations unless a minimum of 7 cm. of the colon distal to the cancer can be removed.

Since cancers that have invaded the serosa will exfoliate viable malignant cells, tumors situated in mobile portions of the colon should be wrapped in gauze during resection. Finally, because of direct extension of the lesion, adjacent structures, such as the bladder, ureter, small intestine, kidneys, stomach and liver, may be involved. When possible, adjacent involved structures must be widely sacrificed in order to preclude local recurrence. Here, however, one is frequently confronted with the problem of grossly distinguishing frank invasion by the tumor from an inflammatory reaction in which the colon is adherent to an adjacent organ, particularly the small intestine, bladder, uterus or ureter. In these situations, unfortunately, the surgeon is often forced by anatomical limits to cut through edematous, inflamed tissues. If so, the cancer may recur locally, even though the margins of the specimen are clear on microscopic examination.

#### *Spread via Lymphatics*

Most studies indicate that, in approximately 60 per cent of the cases, careful examination of the resected specimen will reveal metastases in the lymph nodes (1, 9, 15, 22). For this reason, large amounts of mesentery containing the lymph nodes must be excised, the blood vessels being ligated at their origins. Wide excision of the mesentery containing these nodes is perhaps the most important measure available today for preventing regional recurrences of cancer.

#### *Hematogenous Spread*

Venous invasion has been observed microscopically in 15 to 35 per cent of the patients with cancer of the colon (5, 8, 10, 11, 17). The presence of tumor cells in the venous blood draining the lesion has been demonstrated by numerous investigators (7, 12, 13). Measures to counteract embolic spread via the mesenteric veins includes preliminary ligation of these veins gentle handling of the primary tumor, and adjuvant chemotherapy.

*Adjuvant Regional Chemotherapy.*—The value of regional chemotherapy at the time of operation has been proved by ex-

perimental studies, although thus far it has been impossible to apply to the human subject certain information obtained from animal studies. That current chemotherapeutic agents will, by direct action upon cancer cells, materially prolong the lives of these patients is debatable. In this connection, Rousselot and Cole have introduced a well conceived adjuvant procedure designed to destroy or injure cancer cells within the lumen of the colon as well as those draining into the collateral mesenteric lymphatic and venous channels (26, 27, 28, 29). The tumor-bearing area is isolated between umbilical tapes, and nitrogen mustard or 5-fluorouracil is injected directly into the isolated segment. Circulation to the involved area is allowed to continue for 30 minutes before the mesenteric vessels are ligated. The rationale of this measure is that "Maximal drug concentration in the desired area could result in injury to or destruction of free floating viable cells present within the gastrointestinal segment, the intramural mesenteric veins and lymphatics, and the systemic circulation". Rousselot and Cole report that their results appear to indicate an increase of the survival rate of patients so treated as compared to that of controls (29).

*Adjuvant Systemic Chemotherapy.*—In a nation-wide program carried out in hospitals in the United States in an attempt to combat hematogenous spread of the disease, 693 patients with cancers of the colon were given Thio-TEPA systemically at the time of operation and postoperatively (18, 20, 22). The findings indicated an increase of 15 through 84 months in the survival of female patients with metastases in the mesenteric lymph nodes. This appears to reflect an alteration of the hormonal environment by the Thio-TEPA, rather than a direct action of the drug upon the cancer cells themselves. No significant increase in the survival time of male patients was observed.

### *Implantation*

*Site of Anastomosis.*—Following resections of the colon, the incidence of recurrence at the site of anastomosis has been reported by various authors as being from 10 to 20 per cent (2, 3, 6, 19). This complication can be related to 1) implantation of the tumor cells, 2) inadequate excision of the tumor, 3) extension from an adjacent metastasis into the colon, and 4) a second primary tumor. It has been estimated that at least 75 per cent of anastomotic recurrences, which develop most often after resection of the sigmoid or rectosigmoid, are the result of implantation of malignant cells.

That malignant tumors are capable of exfoliating cells into the lumen of the bowel is well known. As a precaution against this contingency, certain therapeutic measures should be carried out, as follows: 1) The colon above and below the tumor should be doubly ligated with umbilical tapes (30). 2) The resection should include 6 to 7 cm. of the colon both below and above the lesion. 3) The segment distal to the tapes should be irrigated (20). Following resection of the rectosigmoid, irrigation is carried out after the colon is divided but before the clamps are removed, a rectal catheter and 2000 to 3000 c.c. of sterile water being used. In a review of his own cases, Rosi observed that routine irrigation of the rectal segment reduced the rate of recurrence at the anastomosis from 19.5 to 2.9 per cent (24). 4) Finally, once the clamps have been removed and the ends of the colon have been opened, a narrow rim of tissue is excised from the cut end of each segment (28).

*Peritoneal Cavity and Wound.*—The incidence of implantation of the peritoneal cavity and wound can be minimized if the following points are observed at operation: 1) The edges of the wound are protected by waterimpermeable cellophane drapes. 2) The tumor, if in a mobile portion of the colon, is wrapped with dry pads and handled gently. 3) The colon and its mesentery are widely excised, with care to avoid cutting through edematous planes, when possible. 4) Gloves and drapes are changed frequently, and instruments are re-autoclaved after being used one time. Although numerous experimental studies on laboratory animals have shown the usefulness of irrigation of the peritoneal cavity, to our knowledge no clinical study has been carried out which demonstrates conclusively the effectiveness of routine irrigation in the human being. It is doubtful that any such study on patients can be valid because of the variations in the types of tumor, the extent of the disease, and the operative techniques employed. Over the past eight years, it has been our custom to instil a solution of 2 mg. % of nitrogen mustard into the peritoneal cavity at the beginning of the operation.

## SURGICAL TECHNIQUE

A clear understanding of the anatomic arrangement of the lymph vessels that drain the various segments of the colon is essential if one is to perform adequate resections. For the sake of simplicity, the lymphatics generally follow the blood vessels supplying the region involved. Initially, the lymphatic spread

is embolic and follows a predictable course (14). Only after the primary nodes become obstructed by the cancer does the lymphatic spread continue unpredictably, either in a retrograde direction, or in any direction, through the myriad collateral vessels. From a practical standpoint, the surgeon is concerned chiefly with the primary group of lymph nodes, since few, if any, patients are cured after the tumor has obstructed this group and invaded the secondary nodes.

### *Carcinoma of the Cecum. Right Colon and Hepatic Flexure*

For cancers arising in the cecum, right colon or hepatic flexure, resection includes the terminal 12 to 15 inches of the ileum, the cecum, right colon and proximal half of the transverse colon. The cecum and right colon being retracted to the left, this segment is mobilized, first, by longitudinal incision of the lateral peritoneal attachment in the right paracolic gutter and division of the fascia propria (fascia of Toldt) in a similar direction. The spermatic or ovarian vessels, together with the ureter, are displaced posteriorly. The hepatocolic ligament is then clamped, divided and ligated. The fascia propria is next divided anterior to the second part of the duodenum, and the duodenum is also carefully displaced posteriorly. The right corner of the greater omentum is now entered and the proximal half of the gastrocolic omentum is divided just outside the gastroepiploic arcade. Once this portion of the mobilization is complete, the colon is retracted to the right and the mesentery of the terminal ileum is incised, the incision being carried just to the right of the root of the small bowel mesentery along the lateral border of the superior mesenteric vein, thence upward through the middle portion of the transverse mesocolon. Two major colic arteries are ligated at their origins, together with their accompanying veins. Because of the variations in the origin of the right colic artery, in the majority of cases these two vessels are the ileocolic and the middle colic artery. Care should be taken in handling the veins, especially the small vein coming off the anterior surface of the lower border of the pancreas (the inferior pancreatic duodenal vein which empties into the gastroepiploic venous system). The ileum and mid-transverse colon are sutured end-to-end, interrupted nonabsorbable sutures being placed in the outer layer and interrupted N<sup>o</sup> 000 chromic catgut in the inner layer. If the terminal ileum is extremely small, a side-to-side anastomosis may be performed. The lateral peritoneal gutter is not peritonealized.



### *Carcinoma of the Distal Transverse Colon and Splenic Flexure*

The blood supply of the distal transverse colon and splenic flexure is derived from the left brach of the middle colic artery and the left colic branch of the inferior mesenteric artery. Thus, by virtue of this dual arterial blood supply, the lymphatics lie along the arcade formed by these two vessels. In this circumstance, removal of the entire transverse and descending colon and their mesentery is required (25). Because of the technical difficulties involved in anastomosing the hepatic flexure to the sigmoid, we prefer to resect the entire right colon and suture the terminal ileum to the sigmoid, en-to-end. Again, the blood vessels are ligated at their origins to facilitate complete removal of the affected mesentery.

### *Carcinoma of the Descending Colon and Sigmoid*

For resection of these segments, we prefer a midline abdominal incision extending from the xiphoid to the umbilicus. Mobilization is begun with an incision of the lateral peritoneal attachment from below upward. The fascia propria is next incised, also in a superior direction, beginning about midway of the mesocolon. At its junction with the fascia propria, Gerota's fascia is displaced with a sponge stick posteriorly until the inferior mesenteric vein can be visualized from the left side (the raw surface of the mesentery). The ureter and the left spermatic or ovarian vein are identified and displaced posteriorly with Gerota's fascia; frequently, as the colon is retracted anteriorly, these structures are observed lying within the lower third of the mesentery. The phrenicocolic ligament is next divided. For maximum mobilization of the transverse colon, the greater omentum must be detached from this segment. This is facilitated by first retracting the omentum cephalad and the colon toward the patient's feet. The incision is begun in the relatively avascular portion of the greater omentum near the inferior border of the splenic flexure and carried well over to the right side of the transverse colon.

The splenic flexure is not completely mobilized until its fascia propria is incised sufficiently to permit the flexure to slide easily in a medial and inferior direction over the anterior surface of the kidney. Mobilization of the left colon is continued toward the right until the left lateral surface of the aorta is visible and the origin of the inferior mesenteric artery is identified. The node-bearing tissue along the left anterolateral wall of the aorta is excised proximal and distal to the origin of the inferior mesenteric artery. Once these lymph nodes are cleared,

the left colon is brought back into its normal position and the posterior parietal peritoneum is divided parallel and just to the right of the aorta. The incision is then continued upward to the duodenaljejunal junction. At the lower border of the pancreas, the inferior mesenteric vein is divided and ligated. The lymphatic tissue along the right anterior wall of the aorta is next excised from above downward. The inferior mesenteric artery again is identified and is dissected away from its mesentery, beginning at its point of origin and continuing along its course in the root of the mesosigmoid; this is accomplished by an incision through the tough perivascular tissues bordering the artery on the right. The left colic and sigmoid branches are identified, ligated and divided. With the upper portion of the rectum retracted sharply toward the symphysis pubis, the presacral space is entered and the rectum is dissected from the hollow of the sacrum. The terminal portion of the inferior mesenteric artery, i.e., the superior hemorrhoidal artery, is stripped from its mesentery down to a point where the rectosigmoid artery originates, or to the bifurcation of the superior hemorrhoidal artery. At this point, appropriate measurements are taken to insure resection of a minimum of 7 cm. of normal bowel distal to the tumor. The incision is then continued downward along the lateral peritoneal gutter, posterior to an across the base of the bladder in the male, and posterior to the vagina in the female. The medial peritoneal flap is constructed in a similar manner, the incision joining its counter incision posterior to the bladder, or to the vagina. The proximal colon is divided just at or distal to the splenic flexure, with care to preserve the marginal artery and thus to insure the viability of the proximal colon. The ends of the bowel are clamped, the distal segment is irrigated through a rectal catheter, 3000 c.c. of distilled water being used for this purpose, and an end-to-end anastomosis is accomplished.

#### SUMMARY

With the use of cancer therapy as it exists at the present time, it is doubtful that any dramatic improvement of the survival rate of patients with cancer of the colon can be expected. Surgeons, however, can attempt to make diagnoses of the disease in its early stage, and to reduce the morbidity and mortality of many patients through more thorough preoperative preparation and meticulous attention to surgical principles and techniques. Also, in many cases surgeons today can reduce significantly the incidence of local and regional recurrences following resection. Certain fundamental concepts are briefly reviewed herein; if applied, they will be found of value.

## RESUMEN

Es dudoso que con la terapéutica cancerológica del momento actual se pueda esperar una mejoría importante en la tasa de sobrevivencia de los enfermos con cáncer de colon. Los cirujanos, sin embargo, pueden intentar realizar el diagnóstico en etapas más precoces y reducir la morbilidad y mortalidad de muchos enfermos mediante una más cuidadosa preparación preoperatoria y una atención más meticulosa de los principios quirúrgicos y técnicos. También, en muchos casos, los cirujanos pueden reducir de una manera significativa la frecuencia de recidivas locales y regionales después de la resección. Se hace la revisión de ciertos conceptos fundamentales que resultan de valor si son debidamente aplicados.

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