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Method for Dissection of Mesenteric Metastases in Mid-gut Carcinoid Tumors

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Abstract. With adequate medical management the midgut carcinoid tumor generally is an indolent malignancy associated with substantial life expectancy and appreciable life quality, even in the presence of liver metastases and significant tumor burden. Abdominal complications may occur in this entity of carcinoids owing to entrapment of intestines and encasement of mesenteric vessels by mesenteric metastases and associated marked mesenteric fibrosis. This may be the cause of abdominal pain, disabling diarrhea, weight loss to the extent of malnutrition, and eventually the risk of death with acute or chronic intestinal obstruction or intestinal gangrene. Operative removal of the mesentericointestinal lesion is often indicated to prevent or treat these complications but may be technically difficult when mesenteric metastases extend in the vicinity of major vessels in the mesenteric root. At laparotomy 56 patients with advanced midgut carcinoids underwent removal of the mesenteric tumor with a method for preserving the mesenteric vessels. This was feasible by mobilizing and releasing the right colon and mesenteric root from posterior adhesions, identifying the mesenteric artery below the pancreas, and free-dissecting this artery on the tumor capsule in the mobilized mesentery. Dissection was successful even with tumors initially judged inoperable unless tumor growth completely surrounded the mesenteric vessels or extended retroperitoneally. One patient was subjected to distal intestinal artery bypass. Symptom relief was been substantial and often of long duration after mesenteric tumor removal in patients who prior to surgery often had threatening intestinal ischemia. Patients with advanced midgut carcinoids may benefit markedly from dissectional removal of mesenteric tumors, which (conceivably better than conventional wedge resection) preserves the length of the remaining intestine.

The metastasizing midgut carcinoid tumor has been the most common cause of carcinoid syndrome, with its bothersome features of flush, diarrhea, and a carcinoid heart disease with fibrotic heart valves and eventually failing heart disease [1–3]. It has recently been possible to treat this syndrome medically with long-acting somatostatin analogs and interferon [4–7]. Successful alleviation of symptoms by this therapy and apparently improved survival prospects have increased the possibilities and requirements of abdominal surgery in patients with midgut carcinoid tumors [8–11]. This surgery may aim to prevent or treat abdominal complications resulting from growth of the mesentericointestinal lesion or merely facilitate treatment of the carcinoid syndrome and the malignant disease by reducing the tumor burden [8–10, 12–17].

The primary midgut carcinoid has generally been located in terminal portions of the small intestine as a small, submucosal tumor, often measuring 10 mm or less [9]. Despite the inconspicuous size, it has been associated with mesenteric metastases in high frequency; and in contrast to carcinoids of other origin, such metastases have occurred with the smallest lesions [9]. The mesenteric metastases have typically grown larger than the primary tumor and have exhibited an unusual tendency to induce marked mesenteric fibrosis, possibly as a result of growth factors or other substances released in the vicinity of the mesenteric mass [9, 18, 19]. The fibrosis around mesenteric metastases tends to cause shrinkage and fixation of the ileal mesentery and the mesenteric root to the retroperitoneum, with fibrous bands or tumor often attaching to and sometimes obstructing not only loops of the distal small intestine but also the horizontal duodenum and occasionally parts of the transverse or sigmoid colon [8, 9]. The primary tumor has seldomly been large enough to obstruct the intestinal lumen, and causes of obstruction have more often been fibrotic entrapment and angulation of involved intestines or overgrowth of mesenteric tumor [9]. In advanced cases the mesenteric vessels may be encased as well, with resulting intestinal venous stasis and ischemia and occasionally impairment of the arterial circulation in segments of the intestine [8, 9, 20–23].

Approximately half the patients with midgut carcinoids have initially presented with, and required surgery for, intestinal obstruction or merely acute abdominal pain, often with an unknown diagnosis [1, 9, 10, 24–27]. In some of these patients the primary tumor and adjacent mesenteric metastasis have been easily removed by wedge resection of the mesentery and limited intestinal resection. In other cases the mesenteric lesion has been more advanced and has sometimes even appeared inoperable, with entrapped loops of intestine, fibrotic adhesions, and a large mesenteric tumor extending high in the mesenteric root [9]. A reluctant attitude toward operation has been common in such cases, especially in the presence of liver metastases, but surgery may be urgently required in these patients, who may otherwise suffer from

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Table 1. Distribution of preoperative symptoms in patients subjected to dissection of mesenteric metastases.

Symptom	No.	%
Abdominal pain	39	72
Weight loss	19	35
Diarrhea	35	65
Intestinal obstruction	16	30

intestinal venous ischemia and partial or complete intestinal obstruction, with abdominal pain, aggravated diarrhea, malnutrition, and general malaise [1, 2, 8–10, 23, 28].

We have previously reported that operative removal of the mesentericointestinal lesion may be associated with considerable, durable symptomatic relief and substantial periods of survival with appreciable life quality, even in the more compromised patients with midgut carcinoids [8–11]. Because this surgery may be technically difficult, the present contribution details a method for dissecting the mesenteric tumor in patients with advanced midgut carcinoids, which (better than conventional wedge resection) ensures the intestinal vascular supply and enables more limited intestinal resection.

Materials and Methods

Patients

During 1980–1999 a total of 163 patients with midgut carcinoids were subjected to surgery at our institution. Of these patients, 107 were operated on between 1980 and 1993 and have been previously reported, with details of metastatic progression, symptom alleviation, long-term survival, and the possibility of maintaining ordinary daily physical activity despite the presence of advanced carcinoid disease [10, 11]. In the present contribution 56 patients operated on after 1993, who were subjected to more or less extensive dissectional removal of mesenteric metastases, are reported. Most of the patients had advanced disease with mesenteric lymph gland metastases (all patients), liver metastases (44 patients, 79%), or extraabdominal metastases (11 patients, 20%).

All patients were included in a medical and surgical treatment program, as previously described [4, 7, 9–11, 29–32] with mainly octreotide (Sandostatin), interferon, or combinations thereof for various time periods. Liver embolization was part of this treatment program, mainly in patients who no longer responded to medical therapy. Patients were subjected to surgery for removal of the mesentericointestinal tumor in the presence of symptoms of threatening abdominal complications, but also liberally in the absence of such distinct symptoms. The indications for surgery in some patients were thus more or less obvious intestinal obstruction or threatening intestinal ischemia and in others less severe but often feeding-related abdominal pain, unspecific weight loss, or disabling diarrhea (Table 1). Liver metastases were surgically removed when possible [8, 9]. Preoperatively, most of the patients underwent various investigations for determination of tumor extension or as part of the routine follow-up. The investigations comprised computed tomography (CT) with contrast enhancement of the abdomen and sometimes percutaneous ultrasonography (PUS); many patients were also subjected to Octreoscan examination and fewer to bowel contrast studies or mesenteric artery angiography. Echocardiography was frequently applied to exclude the presence of carcinoid heart disease prior to major abdominal surgery. Peroperative Sandostatin infusion (500 μg in 500 ml saline, 50 μg/hr) was applied routinely to minimize the risk of carcinoid crisis during surgery.

Surgery

Patients were operated with an extended low midline abdominal incision. As an initial procedure the intestine was explored from the ligament of Treitz to the ileocecal valve to identify the primary lesion, possible multiple small intestinal carcinoids, mesenteric metastases, and the anticipated required extent of intestinal resection. The right colon and small intestinal mesentery were mobilized from posterior adhesions toward the retroperitoneum up to the level of the horizontal duodenum and the lower pancreatic border. Tumorous or fibrotic adhesions to the serosa of the horizontal duodenum frequently required sharp transection. The superior mesenteric artery and vein were identified first below the pancreas and then followed dorsally in the elevated mesenteric root. The vessels were further exposed by incision in the right colon mesentery above and along the right colic artery or the ileocolic artery, with medial extension of the incision to unwrap the peritoneum ventrally over the mesenteric root.

With this exposure it was generally possible to determine and rank the level of mesenteric tumor extension along the major mesenteric vessels according to our own staging classification (Fig. 1), which is used to judge whether the mesenteric tumor is operable. Stage I consists of tumors located close to the intestine, stage II of tumors involving arterial branches near their origin in the mesenteric artery, stage III of tumors extending along (without encircling) the superior mesenteric artery trunk, and stage IV of tumors that extend retroperitoneally, behind or above the pancreas, or grow around the mesenteric artery and involve the origin of proximal jejunal arteries on the left side of the superior mesenteric artery.

Removal of the mesenteric tumor was accomplished by incising the peritoneum longitudinally over the mesenteric artery, transecting fibrotic adhesions, and cautiously dissecting the artery and main mesenteric vein from the tumor capsule. Distal arterial (and venous) branches (ileocolic artery, right colic artery, ileal or occasionally jejunal arteries) often had to be divided, depending on the extension of the tumor masses. Great care was taken to preserve important vascular collaterals and arcades along the intestine, and resection of the involved intestinal segment was postponed until dissection of the mesenteric tumor was complete.

Results

Preoperative Investigations

Continuous comparison with operative findings substantiated that CT with intravenous contrast enhancement was by far the most valuable investigation prior to surgery. CT efficiently outlined the size of the mesenteric tumor, its relation to the superior mesenteric artery, and possible extension retroperitoneally or above the pancreas. Consequently CT became a general requirement for evaluating the operability and appropriate planning prior to surgery (Figs. 2, 3). PUS generally did not provide further informa-

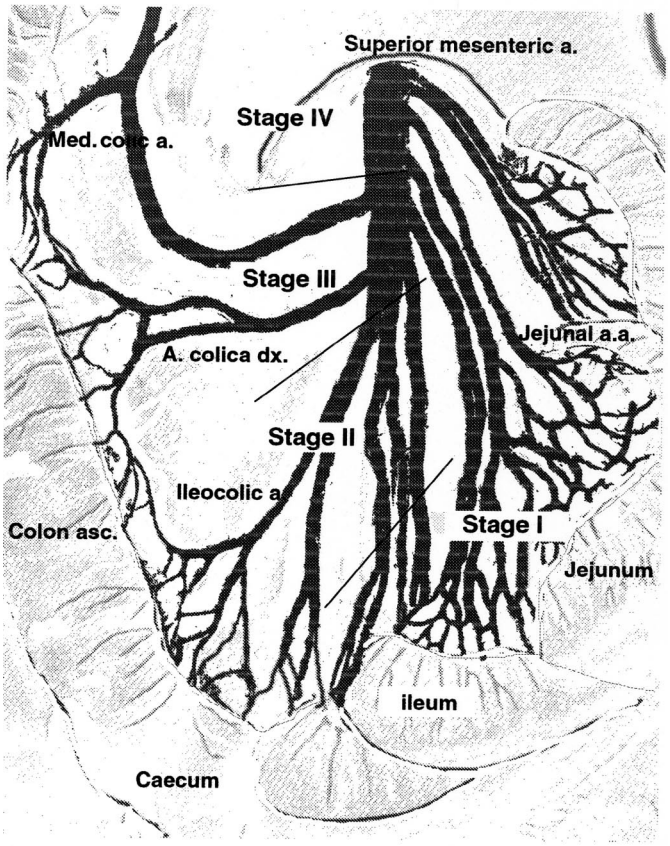

Fig. 1. Stages of midgut carcinoid mesenteric metastases. Stage I consists of tumors located close to the intestine; stage II is tumors involving arterial branches close to their origin in the mesenteric artery; stage III is tumors extending along, without encircling, the superior mesenteric artery trunk; stage IV tumors extend retroperitoneally, behind or above the pancreas, or grow around the mesenteric artery and involve the origin of proximal jejunal arteries on the left side of the superior mesenteric artery. a.: artery; dx.: dexter; a.a.: arteries; asc.: ascendens.

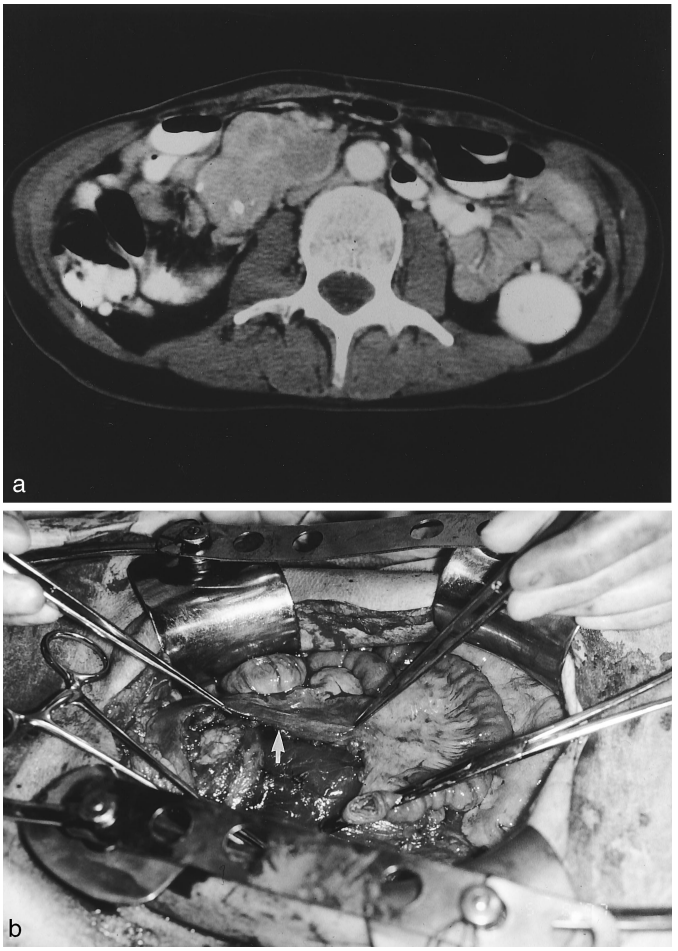

Fig. 2a. Computed tomography (CT) image of mesenteric tumor in a midgut carcinoid patient with severe cachexia and abdominal pain due to mesenteric ischemia. **b.** Mesenteric tumor removed with free dissection of the mesenteric artery (arrow) in the same patient.

tion on anatomic details. PUS was, however, often used for the initial diagnosis of carcinoid tumors to obtain fine (or semi-fine) needle biopsy from the liver or mesenteric metastases for specific staining (Masson, chromogranin). Bowel contrast studies were applied in patients with symptoms of intestinal obstruction to identify involved intestines and, in particular, to exclude colon involvement. Selective mesenteric artery angiography was not routinely applied but was occasionally required in patients with impaired intestinal circulation, as in the patient subjected to vascular bypass surgery (Fig. 3) (see below). Generally, however, the intestinal vascular impairment of the midgut carcinoids involved peripheral vessels, preferentially veins, and was often not appropriately revealed by angiography. The Octreoscan scintigraphy examination could help determine the endocrine nature of a tumor mass and often efficiently displayed the abdominal metastases but with too low precision for anatomic details to be of help preoperatively. The scintigraphy, however, was of significant value for demonstrating extraabdominal metastases, the presence of which sometimes influenced decisions about extensive surgery [11].

Operation

At surgery the primary tumor was often evident merely as a fibrotic induration on the intestinal serosa adjacent to larger, bulky, generally markedly fibrotic mesenteric metastases with a diameter ranging between 1 and 10 cm (mean 4 cm). There was appreciable conformity between the findings on preoperative CT with contrast enhancement and at operation regarding the size and location of mesenteric lesions; there was less agreement concerning the extent of the fibrosis or the condition of involved intestines. The desmoplastic reaction was generally more extensive with the large mesenteric tumors, although some bulky metastases were equipped with a well defined tumor capsule and were occasionally easier to separate from involved mesenteric vessels than smaller, extensively fibrotic nonparenchymatous tumors without a capsule. In addition to a dominating mesenteric mass, there were frequently additional, smaller lymph gland metastases without a fibrotic reaction along the mesenteric artery or its branches.

Loops of distal small intestine of variable length were generally

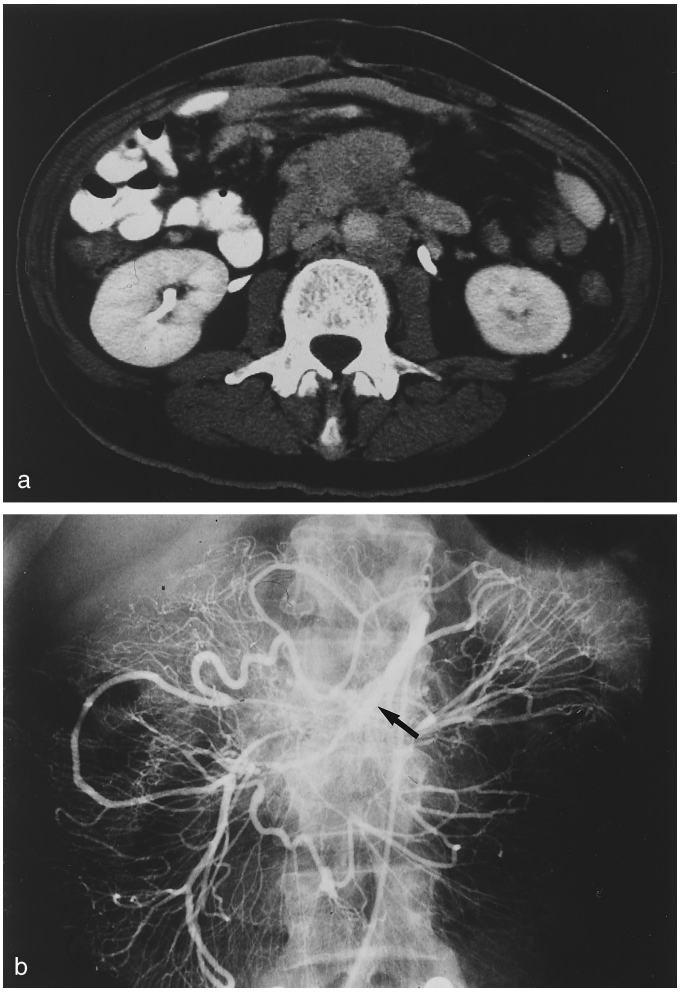

Fig. 3a. CT image of mesenteric tumor in a midgut carcinoid patient with occlusion of the mesenteric artery and incipient ischemia in the entire small intestine (mesenteric artery in the middle of the tumor). **b.** Selective superior mesenteric artery angiography in the same patient showing occlusion of the mesenteric artery trunk (arrow). The patient was subjected to vascular bypass surgery (iliac to ileocolic artery), with relief of abdominal symptoms for 2 years.

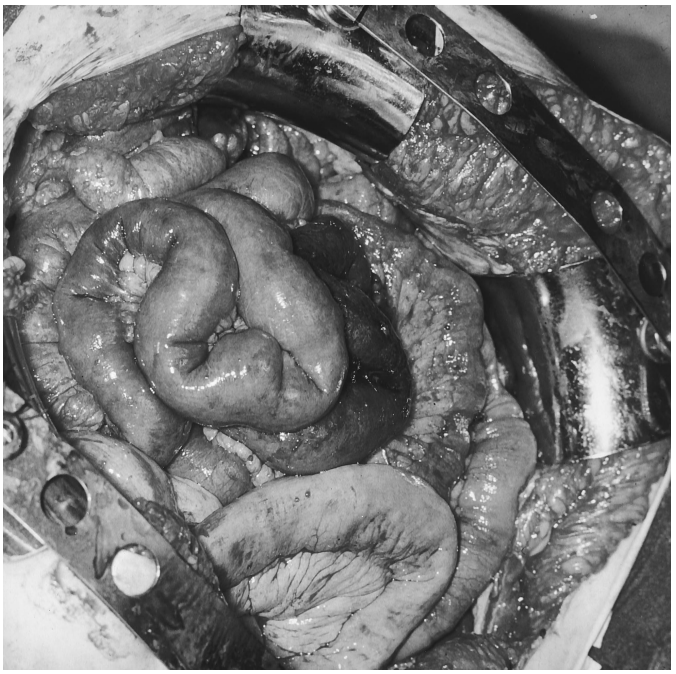

Fig. 4. Segmental venous intestinal ischemia in a patient with midgut carcinoid.

Table 2. Distribution of the stages of mesenteric metastases.

Stage	No.	%
I	13	24
II	12	22
III	22	38
IV	9	16

captured in the desmoplastic reaction, with partial or complete obstruction, congestion, or segmental venous intestinal ischemia (Fig. 4). In one patient (with intractable diarrhea) [28], the congestion encompassed 1.5 m of the distal small intestine. Arterial ischemia with pale cyanosis or a gray, dusky color of the intestine was less common but occasionally comprised distal segments of the small intestine and in two patients the entire small intestine. In patients with large mesenteric tumors there was sometimes marked congestion, with severely dilated veins also in the mesentery.

Because of retraction in the mesentery the relation between metastases and the main mesenteric artery was often not evident prior to dissection, and it was frequently obvious that the artery had been easily compromised by conventional wedge resection. Staging the mesenteric metastases is depicted in Table 2. Once the relation to the mesenteric vessels had been established, stage I tumors were removed by more or less conventional mesenteric and small intestinal resection (generally limited ileal resections), whereas stage II tumors required right-sided colectomy as well. Many stage III tumors initially appeared impossible to remove without endangering the circulation to the entire small intestine. However, concomitant with an origin from lesions in the terminal ileum, most of these tumors were deposited mainly on the right side of the mesenteric artery. In the absence of circumferential growth around the arterial trunk or retroperitoneal extension, tumors at this location could be free-dissected from the mesenteric artery. The intestinal resection could then be confined to a small intestinal segment rendered ischemic by the dissection and the right colon. Stage IV tumors involved more proximal parts of the mesenteric artery, sometimes growing circumferentially around this vessel, and were not possible to remove. Some of these mesenteric tumors were simply transected to allow resection of ischemic or obstructed intestine. Some of these "difficult to handle" metastases originated from jejunal primary tumors.

During all these operations great care was taken to preserve the length of the remaining small intestine, which only rarely was less than 1.5 to 2.0 m (mean 2.5 m). This was accomplished by the dissection procedure and by delaying the intestinal resection until after the mesenteric dissection was complete; it was also done by carefully preserving vascular arcades along the intestine. In one of the two cases with incipient ischemia affecting the entire small intestine (Fig. 3), a vascular bypass was performed with 6 mm

expanded polytetrafluoroethylene (ePTFE) Gore-Tex graft (Gore & Associates, Flagstaff, AZ, USA) (utilizing saphenous vein graft cuffs at both ends to secure mobility) between the right iliac artery and the first ileocolic artery arcade (performed by vascular surgeon S.K.).

Postoperatively, most patients experienced marked symptom relief, as previously described [9]. Those subjected to more extensive intestinal resections generally had diarrhea, requiring treatment with bile salt binders, loperamide, or octreotide (Sandostatin) among others. Complications were encountered in five patients: Two required reoperation for evacuation of not extensive hematoma or fluid accumulation, and three had to undergo adhesive intestinal obstruction release surgically; all of them recovered uneventfully. One patient with intestinal ischemia died 4 weeks postoperatively from dehiscence of the anastomosis.

Discussion

Carcinoids are rare tumors, and consequently few institutions and few surgeons have acquired extensive experience with their biology and management. The midgut carcinoid tumors have distinct features compared to carcinoids of other origin. Because of their capacity to secrete serotonin, tachykinins, and other peptides and amines, they are the most common cause of the carcinoid syndrome [33]. They also have an unusual tendency to induce marked fibrosis in the heart chambers (e.g., the pulmonary and tricuspid cusps) and in the mesentery. In both these locations the desmoplastic reaction may cause serious complications [1–3, 8, 9, 18].

Various substances released by carcinoid metastases (serotonin, tachykinins, growth factors) are likely to induce this desmoplastic reaction, implying that the carcinoid metastases per se are the cause of morbidity [19]. In the abdomen this includes a striking tendency to cause intestinal obstruction by adhesions, compression of the intestine within the growing mesenteric tumor, and eventually encasement of the mesenteric vessels. Increasing attachment of loops of the small intestine to the mesenteric tumor and further retraction of the mesentery occur with continuous growth of the tumor and tend to cause not only progression of abdominal symptoms but also a disease that may become increasingly difficult to manage surgically.

Intestinal venous ischemia or congestion, which has been found in one-third of patients with advanced midgut carcinoids subjected to laparotomy, may be one of the ultimately fearsome, rather specific complications of these tumors [9]. In our experience, the ischemia has been mainly due to compression of mesenteric vessels by tumor and fibrosis, although it has also been assigned a specific angiopathy, "elastic vascular sclerosis," consisting of elastic tissue proliferation in the adventitia of mesenteric arteries and veins [9, 21, 23]. Aggravated diarrhea may be a likely result when ischemia affects a limited segment of the small intestine, and severe watery diarrhea can be expected if major mesenteric veins are occluded [9, 28]. As a clinical sign of threatening intestinal complications, the patients often exhibit intermittent, feeding-related abdominal pain and sometimes weight loss and malnutrition. This type of pain is unlikely to occur merely as a consequence of the carcinoid syndrome, and surgery may be urgently required to determine the presence of partial intestinal obstruction or ischemia [9]. Patients with midgut carcinoids rarely experience marked weight loss or malnutrition merely as a result of a large tumor burden; instead, it often implies advanced mesentericointestinal disease requiring surgery.

We have previously reported that improvement may be significant in patients with midgut carcinoids subjected to laparotomy with abdominal symptoms, and it is especially auspicious in patients with abdominal pain, weight loss, and signs of intestinal obstruction [9, 10]. Alleviation of symptoms has also been propitious and of long duration in patients with mesenteric fibrosis and ischemia subjected to surgery [10]. The natural course of mesentericointestinal disease with midgut carcinoids has not been unequivocally established and can be expected to be variable. However, complications of the mesenteric tumor, together with failing carcinoid heart disease represent the principal causes of disease-specific deaths with midgut carcinoids. Without these complications or with adequate management the patients can expect favorable survival with appreciable life quality [11]. Surgery at an early stage should be of distinct advantage, as it may provide an exceptional possibility to remove the mesenteric tumor before more extensive involvement of major mesenteric vessels have occurred. We thus advocate removal of the mesentericointestinal tumor as a prophylactic procedure and in asymptomatic patients when the patient is considered for medical therapy [10, 11].

Unfortunately the midgut carcinoid is rarely diagnosed before metastases have occurred because the tumor rarely bleeds due to its deep submucosal location and the generally inconspicuous size of the primary tumor. Some patients do not exhibit abdominal symptoms or complications initially and, instead, present with carcinoid syndrome [9–11]. Because these patients generally have liver metastases, they are likely to be offered medical therapy alone and may not be considered for surgery. The presence of liver metastases may be considered an argument against surgical intervention, even in presence of symptoms of abdominal pain and weight loss indicating threatening abdominal complications. In our opinion, the patients with midgut carcinoids should be subjected to repeat surgical consultation during the periods of medical treatment, and surgical removal of the primary mesentericointestinal tumor should be liberally undertaken. Indeed, these patients are likely to benefit markedly from close, continuous cooperation between internists and surgeons.

The presently described method for dissection of mesenteric metastases is somewhat more extensive than what is common surgical technique for other intestinal malignancies. The method has evolved with the increased experience from management of patients with advanced midgut carcinoids. Many of these tumors have initially appeared inoperable (even to the most experienced surgeons) when they are bulky mesenteric tumors extending high up in the mesenteric root. However, because some of these patients have had threatening or manifest ischemia, we have been faced with no other option than to try to remove the tumors. At the same time, it has been crucial to save as much viable small intestine as possible because patients with the carcinoid syndrome are known to do poorly if a short bowel syndrome is created. Based on our experience, we strongly recommend that essential parts of the technique are considered in carcinoid patients with less extensive mesenteric tumors as well to avoid inadvertent injury to major mesenteric vessels in the retracted mesentery.

Patients who have experienced marked and long-lasting relief, especially of ischemic symptoms, have been in poor condition before surgery with severe cachexia. The single patient subjected

to vascular bypass was operated on under such circumstances and has experienced marked relief of abdominal symptoms for 2 years.

It is important also that midgut carcinoid patients are managed by surgeons familiar with the special difficulties and requirements of this surgery, especially because reoperative surgery tends to be associated with markedly increased difficulties. Reoperations are often conducted to resolve intestinal obstruction due to extensive and harsh adhesions between intestines. The reoperated patients generally present with extensive desmoplastic reactions, often with obliteration of the abdominal cavity, harsh adhesions between intestines, and fixation of the intestines toward the abdominal wall and retroperitoneum. These operations often include time-consuming dissection of the extended abdominal adhesions and frequently result in more or less extended resections of the small intestine. This surgery, and indeed any surgery in patients with midgut carcinoids, should be undertaken with great caution, as minor mistakes may easily result in intestinal fistulation, devascularization of major parts of the small intestine, or creation of a short bowel syndrome [8–11]. In our opinion, intestinal bypass should be avoided if possible, mainly because ischemia may develop in a disengaged intestinal segment. Moreover, symptoms may not be alleviated by the bypass procedure, which also tends to complicate repeat surgery. Intestinal bypasses are performed only when extensive tumor growth, carcinoidosis, or fibrosis after previous surgery inhibits appropriate mesenteric dissection.

Résumé

Avec un traitement médical adéquat, les tumeurs carcinoïdes de l'intestin moyen sont considérées comme des tumeurs malignes indolentes associées à une espérance de vie substantielle et une qualité de vie appréciable, même en présence de métastases hépatiques et/ou de masse tumorale importante. Des complications abdominales peuvent se voir, soit parce que les intestins sont pris par le processus malin soit par l'encastrement des vaisseaux mésentériques, plus ou moins associées avec de la fibrose mésentérique intense. Ces complications peuvent être la cause de douleurs abdominales, une diarrhée incapacitante, une perte de poids allant jusqu'à la malnutrition ou encore un risque de mortalité en raison d'occlusion intestinale aiguë ou chronique voire même d'une gangrène. La chirurgie (l'ablation de la lésion mésenterico-intestinale) est souvent indiquée pour prévenir ou traiter ces complications, mais elle peut être techniquement difficile lorsque les métastases mésentériques s'étendent à proximité des vaisseaux majeurs dans la racine du mésentère. Cinquante-six patients ont été opérés d'une tumeur carcinoïde avancée de l'intestin moyen nécessitant une technique de conservation des vaisseaux mésentériques. Celle-ci a été possible grâce à la mobilisation du côlon droit et la libération de la racine du mésentère des attaches postérieures, l'identification et la dissection de l'artère mésentérique supérieure au bord inférieur du pancréas, la libérant de la capsule de la tumeur dans le mésentère ainsi mobilisé. On a réussi cette dissection même en cas de tumeur jugée initialement inopérable, sauf quand la croissance tumorale avait complètement entouré les vaisseaux mésentériques ou s'était trop étendue dans le rétropéritoneum. Un pontage distal a été nécessaire chez un patient. Le soulagement des symptômes a été substantiel et souvent de durée importante chez les patients qui, avant la chirurgie, étaient menacés d'ischémie intestinale. Les patients ayant une tumeur carcinoïde avancée peuvent bénéficier de la dissection et exérèse des tumeurs mésentériques, ce qui, on le conçoit, est meilleure que la résection en coin traditionnelle car elle préserve la longueur de l'intestin restant.

Resumen

Con tratamiento médico adecuado el carcinoide de intestino delgado, aunque sea de gran tamaño o curse con metástasis hepáticas, es una entidad nosológica indolora, con larga supervivencia y adecuada calidad de vida. Las complicaciones abdominales en los carcinoides se originan por la estrangulación del intestino o el encastramiento de los vasos por metástasis o fibrosis secundaria a lesiones infiltrativas del mesenterio. La sintomatología con que cursan estos tumores es: dolor abdominal, diarreas invalidantes y pérdida de peso hasta alcanzar el grado de malnutrición; la muerte del paciente puede producirse, eventualmente, por una obstrucción aguda o crónica o por gangrena intestinal. La extirpación de las lesiones intestino-mesentéricas está formalmente indicada para prevenir estas complicaciones. Sin embargo, la extirpación puede ser técnicamente dificil sobre todo cuando las metástasis asientan en las proximidades de los grandes vasos de la raíz del mesenterio. 56 pacientes fueron laparotomizados extirpándoseles carcinoides avanzados de intestino delgado mediante un método que permite conservar la integridad de los vasos mesentéricos. La técnica propuesta consiste en la movilización y liberación del colon derecho con exposición de la raíz del mesenterio que se libera de sus adherencias posteriores; se identifica la arteria mesentérica superior por debajo del páncreas y se diseca, a lo largo del mesenterio movilizado, hasta alcanzar la cápsula tumoral. Esta disección fue siempre posible incluso en casos juzgados como inoperables, excepción hecha de aquellos tumores que en su crecimiento rodeaban por completo los vasos mesentéricos o se propagaban al espacio retroperitoneal. Sólo en un paciente hubo de realizarse un cotacircuito (by-pass) arterial en intestino distal. Tras la extirpación del tumor mesentérico desaparece la amenaza de isquemia intestinal y los enfermos permanecieron asintomáticos durante un largo periodo de tiempo. Los pacientes con tumores carcinoides de intestino delgado son subsidiarios de la disección y extirpación de la masa tumoral mesentérica; este procedimiento es muy superior a la resección convencional en cuña pues reduce la amplitud de la resección intestinal.

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