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# Computed tomography of mesenteric disease

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***Inflammation, edema, and neoplasms may directly involve the mesentery. Here, the authors illustrate the varied CT appearances of such mesenteric abnormalities.***

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## Introduction

Pathological processes affecting the mesentery are only inferentially assessed with barium studies of the small bowel and colon. Computed tomography (CT) provides a direct, and noninvasive method to examine the mesentery and bowel wall (1-3). Although the CT identification of well defined mesenteric masses, usually from lymphoma or metastasis, have been well recognized, less information is available characterizing other mesenteric abnormalities (4-7). This paper demonstrates the variable CT appearance of mesenteric abnormalities caused by inflammatory disease, edema, direct extension from primary malignant neoplasms, and metastatic disease.

## Methodology

The CT scans of 58 patients with mesenteric disease were reviewed. The patients (30 men and 28 women) ranged in age from 14 to 80 years. Patients with well defined focal masses were excluded. The patients were given oral contrast material and an intravenous contrast agent was used when indicated.

The medical records of all patients were reviewed, and the clinical and pathologic findings and subsequent courses were recorded. The records of patients who underwent surgery were reviewed to determine the extent of mesenteric involvement. Scans were evaluated with respect to: 1, the presence of abnormal soft tissue absorbers in the mesenteric fat; 2, the definition of the segmental mesenteric vasculature including the patency of the major mesenteric vessels; 3, the pre-

sence of mesenteric fluid collections; 4, thickening of bowel loops (colon wall greater than 3 mm in width); 5, the presence of fistulae; and 6, the presence of abnormalities of the retroperitoneal fascia. Disease entities included in the study were: pancreatitis (11 cases), diverticulitis (6 cases), inflammatory bowel disease (5 cases), abscess (6 cases), mesenteric edema (6 cases), primary carcinoma (12 cases), metastatic tumor (12 cases).

## Discussion

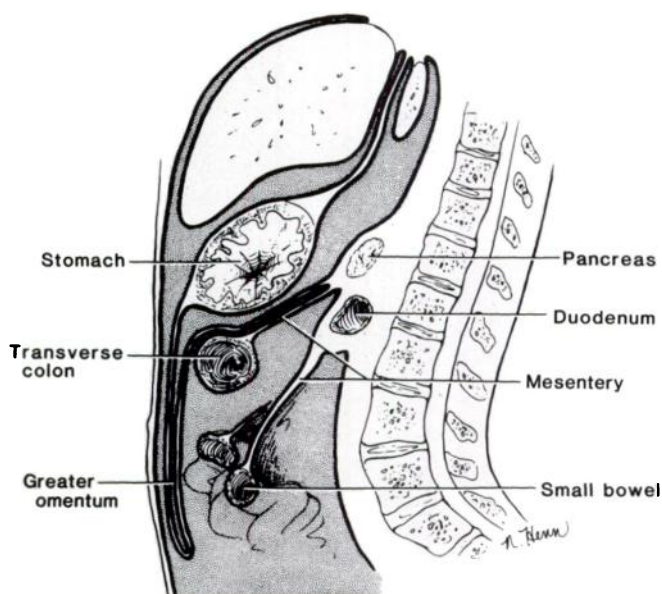
### NORMAL MESENTERY

The mesentery is a reflection of peritoneum onto the bowel surface that supports loops of small bowel and colon (Figure 1). The mesentery consists of two fused layers within which lie mesenteric vessels, lymphatics, nodes, nerves, and a variable amount of fat (2,8,9). This creates a potential subperitoneal space for the spread

of pathology (5). Mesenteric pathology may be separated from abnormalities of the greater omentum since omental pathology is anterior to the transverse colon (Figure 2). In all but the most asthenic patients, variable amounts of mesenteric fat allow the components of the mesentery to be identified on CT.

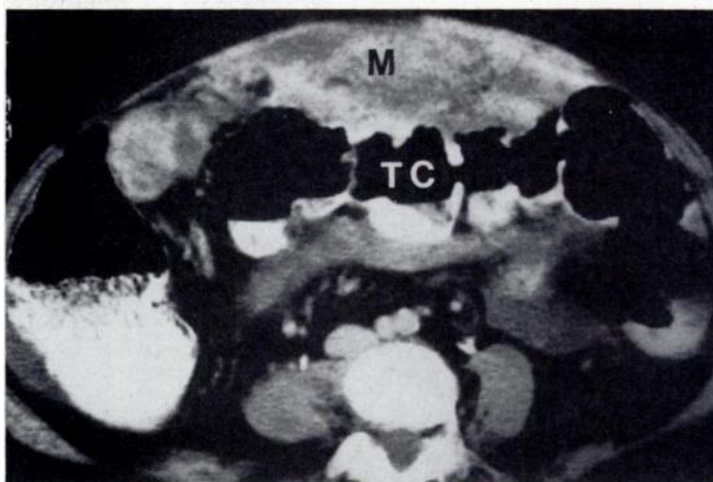
**Figure 1**

This sagittal schematic diagram illustrates the mesentery supporting the bowel and the location of the greater omentum anterior to the transverse colon.

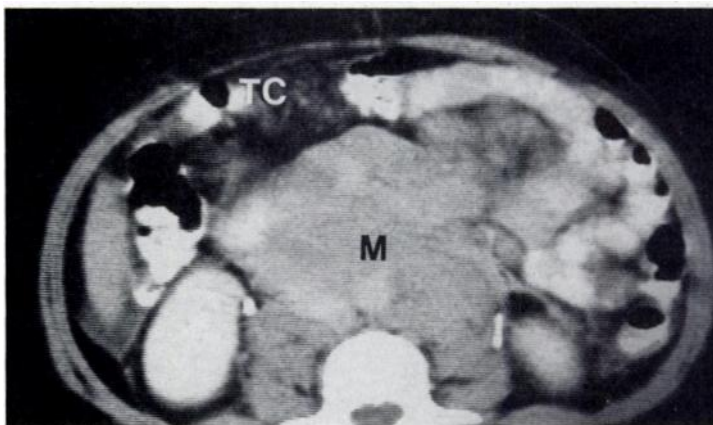


**Figure 2A**

This scan is at the level of the transverse colon, TC. An abnormal soft tissue mass, M, in the expected location of the greater omentum represents omental metastases from colon carcinoma.

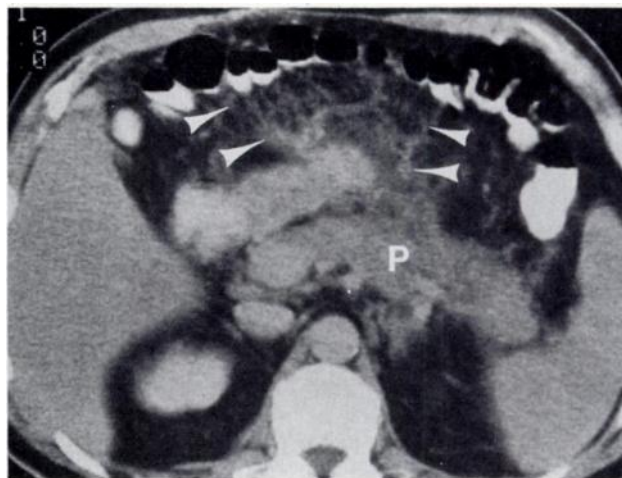
**Figure 2B**

Here the matted mass, M, posterior to the transverse colon, TC, represents mesenteric involvement by lymphoma.



### PANCREATITIS

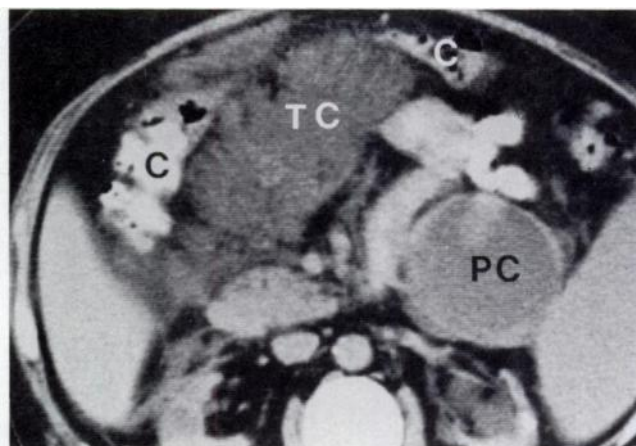
Acute pancreatitis may show a wide spectrum of inflammatory changes. Abnormalities may be limited to the extraperitoneal spaces or extend intraperitoneally secondary to digestive enzymes. Mesenteric abnormalities consist of inflammation and fluid in the mesentery. In our patients, inflammatory changes obliterated the sharp margination of the peripheral mesenteric vessels (Figure 3). Middle colic branches in the transverse mesocolon were most affected. In severe pancreatitis, enzymes may dissect along the transverse mesocolon (2,10,11) (Figure 4).

**Figure 3**

**Pancreatitis** Ill defined soft tissue inflammatory changes are seen in the mesentery (arrowheads). Poor definition of the margins of the body of the pancreas, P, is secondary to pancreatitis

**Figure 4**

**Pancreatitis** This patient had pancreatitis and a large pancreatic pseudocyst, PC, in the tail of the pancreas. Extensive inflammatory changes in the transverse mesocolon, TC, cause narrowing of the transverse colon, C.



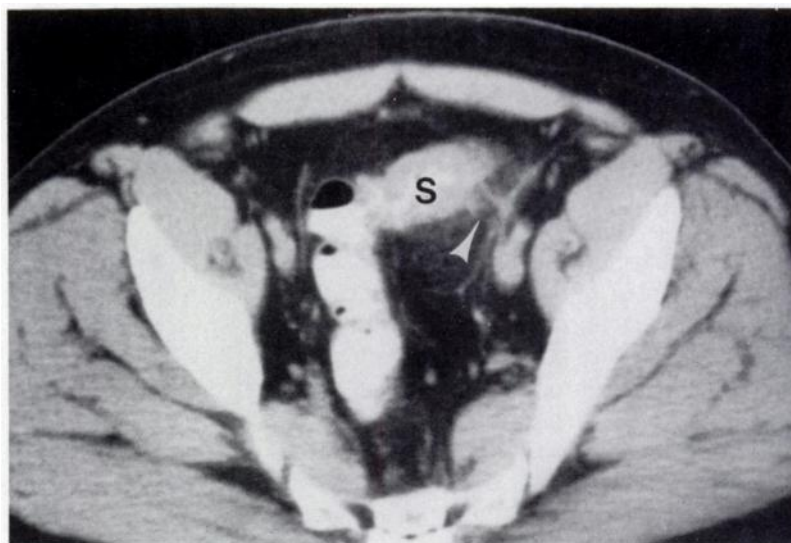
### DIVERTICULITIS

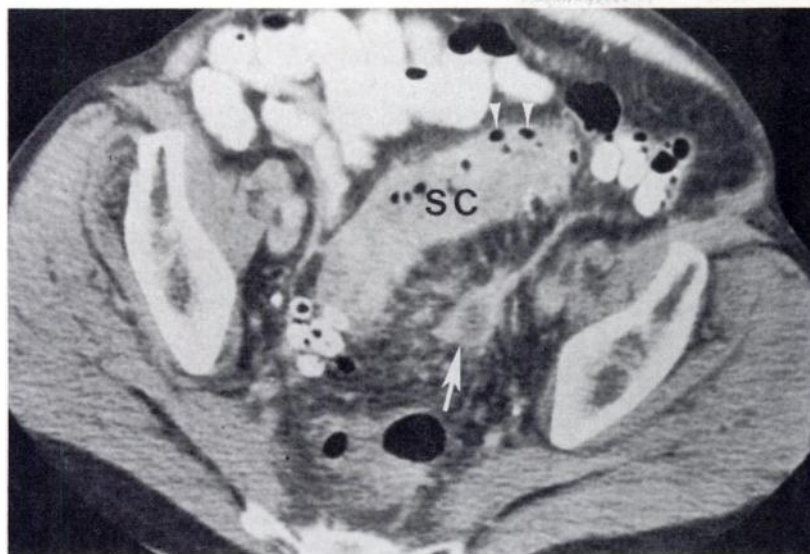
The diagnosis of diverticulitis is usually based on clinical examination and the selective use of a barium enema. CT is of value in defining the extent of an inflammation because it identifies bowel wall thickness, records the appearance of pericolic fat and demonstrates the relationship of inflammatory masses to adjacent organs (12,13) (Figures 5 and 6). An additional advantage is that the administration of a rectal contrast agent is not essential. In one study, CT iden-

tified the extent of pericolic inflammatory disease more accurately than a barium enema in 41% of cases (12). In all of our cases, the sigmoid was thickened with contiguous mesenteric stranding. Although perforated colon carcinoma may mimic diverticulitis, the findings of diffuse disease involving the sigmoid are more suggestive of an inflammatory process, especially if they are associated with numerous diverticula or a sinus tract (Figure 7).

**Figure 5**

**Diverticulitis** Thickening of the sigmoid colon, S, and mild inflammatory stranding (arrowhead) are seen in this case.

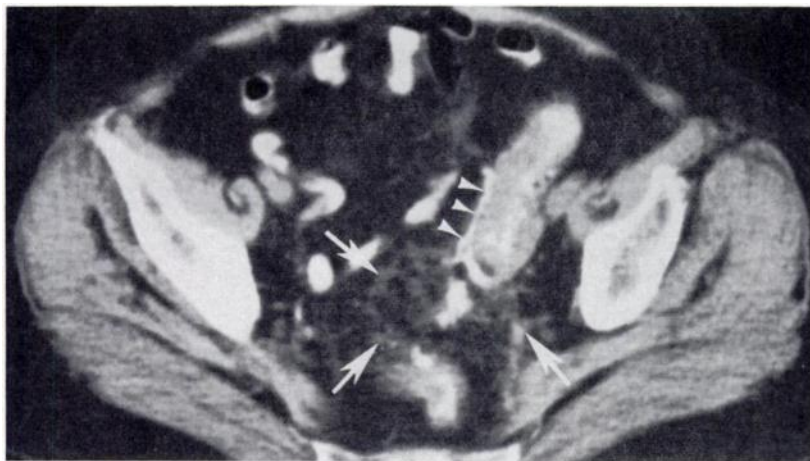


**Figure 6A**

**Diverticulitis** Multiple diverticula (arrowheads) are identified in a thickened sigmoid colon, SC. Radiating inflammatory changes in the adjacent mesentery surround a mesenteric abscess (arrow).

**Figure 6B**

Here a mottled fluid collection with multiple gas bubbles is seen within the mesentery (arrows) in a section 1 cm caudal to the plane of Figure 6A. It represents a large mesenteric abscess secondary to diverticulitis.

**Figure 7**

**Diverticulitis** An intramural sinus tract (arrowheads) can be identified along a segment of thickened sigmoid colon. Inflammatory changes are present in the adjacent mesentery (arrows).

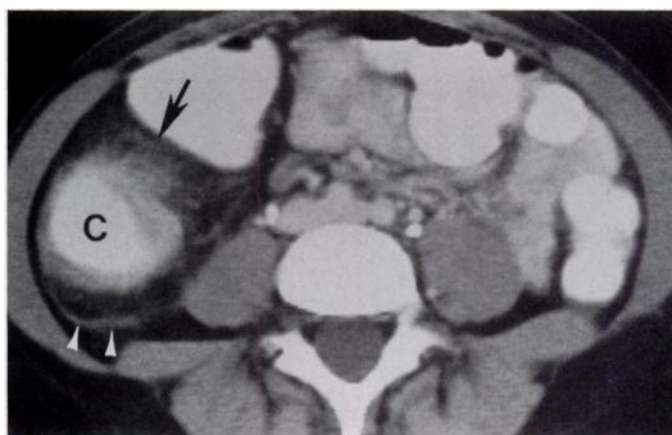
# INFLAMMATORY BOWEL DISEASE (CROHN'S DISEASE)

Advanced Crohn's disease is a granulomatous inflammation that results in extensive bowel wall thickening. With progressive ulceration, the process may extend into the surrounding fat and adjacent bowel loops with fistulization (Figure 8). Conventional radiography only indirectly assesses mesenteric and bowel pathology. Separation of bowel loops may be secondary to fibrofatty proliferation (the accumulation of fatty

tissue with a higher attenuation than the  $-100$  to  $-160$  H of normal mesenteric fat), abscess formation or inflammatory tissue (14) (Figure 9). CT can be used to distinguish these processes. This is helpful in management because patients with fibrofatty changes may be managed conservatively, whereas those with abscesses may require the institution of antibiotic therapy, changes in steroid dosage, or drainage.

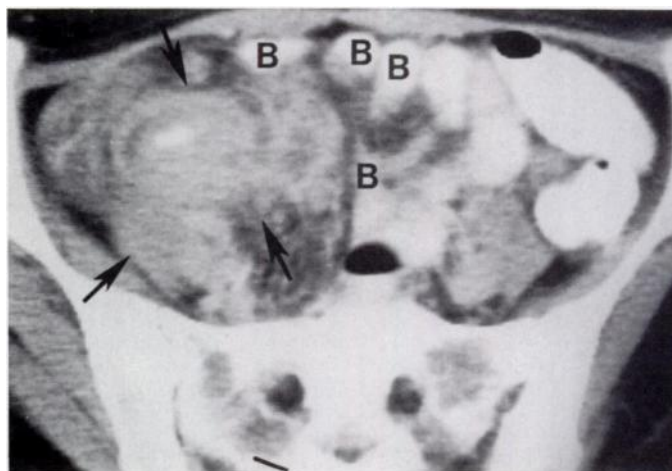
**Figure 8**

**Crohn's disease** Marked thickening of the ascending colon, C, is identified together with adjacent thickening of Gerota's fascia (arrowheads). There is extensive inflammatory change extending into the mesenteric fat (arrow) with associated fibrofatty proliferation.



**Figure 9**

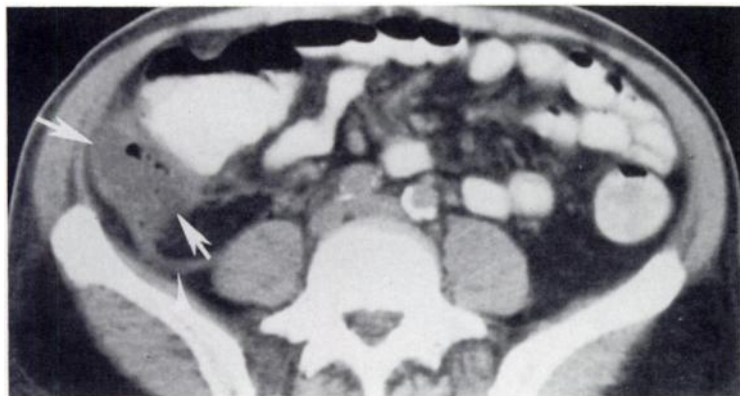
**Crohn's disease** Here a large inflammatory mass (arrows) associated with bowel wall thickening and inflammatory changes in the surrounding mesentery displaces adjacent loops of small bowel, B.



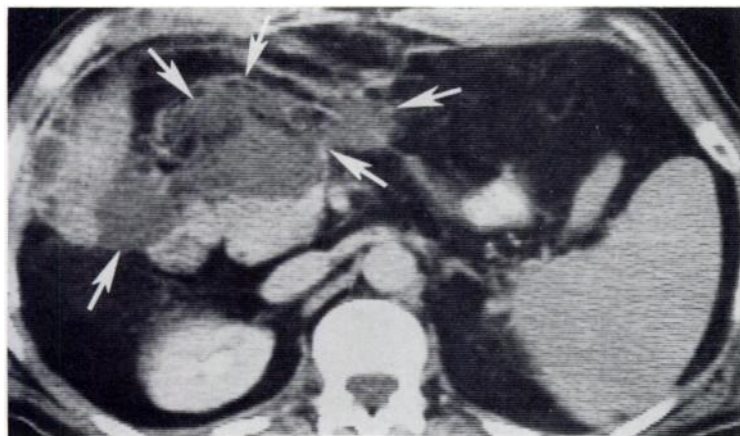
## ABSCESS

In four of our patients, abscess formation was the sequella of appendicitis (Figure 10). In patients with suspected appendicitis and supportive findings on physical examination, radiologic studies are usually unnecessary. In 15-30% of patients, however, the clinical diagnosis may be in doubt and radiography may contribute to the diagnosis. Plain radiographic findings including focal ileus, a calcified appendicolith, a right lower quadrant mass, or an extraluminal fluid collection may be helpful in establishing the diagnosis. Evidence of a mass effect (extrinsic pressure) on the cecum and terminal ileum or

poor filling of the appendix on barium enema are supportive findings. CT findings include a complex mass with associated fluid, inflammatory changes and bowel wall thickening (15). When a mass is identified, surgery is usually indicated. The identification of an abscess may, however, indicate that percutaneous drainage with delayed surgical intervention is appropriate. The CT demonstration of the extent of an abscess may facilitate its drainage (16). If inflammation is shown to involve the mesentery diffusely, however, the process may not be accessible to percutaneous drainage (Figure 11).



**Figure 10**  
**Perforated appendiceal abscess** A complex fluid and air collection (arrows) is seen in the right lower quadrant with associated fascial thickening (arrowhead) and inflammatory changes.



**Figure 11**  
**Abscess** A poorly marginated, infected fluid collection (arrows) is seen involving the mesentery. This abscess developed secondary to a bullet wound.

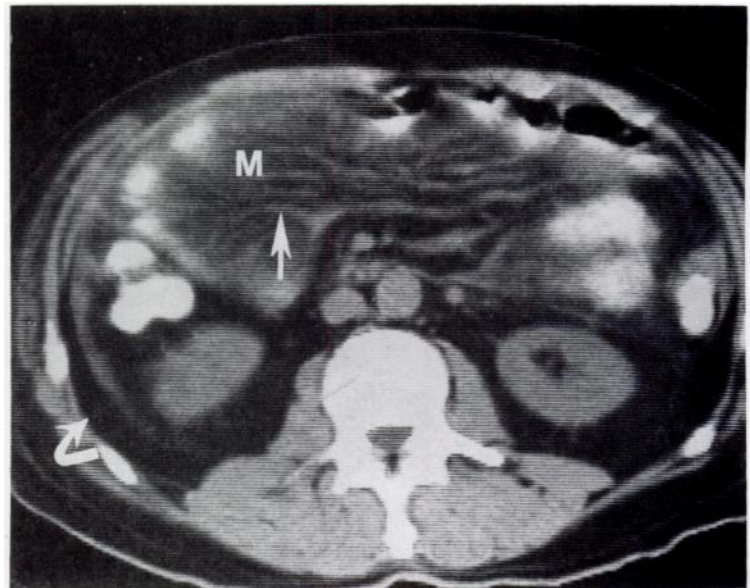
## MESENTERIC EDEMA

Mesenteric edema produces a characteristic appearance with obscuration of the normally sharply margined mesenteric vessels (Figure 12). In contrast to an inflammatory process, edema produces increased attenuation that involves the entire mesentery and is associated with haziness of the mesenteric vasculature. In

contrast to the appearance of a malignant process, no masses are present. The additional finding of greater than normal attenuation of the subcutaneous tissues aids in the recognition of a hypoalbuminemic state. Scrutiny of the larger mesenteric vessels is important in excluding mesenteric vein thrombosis (17).

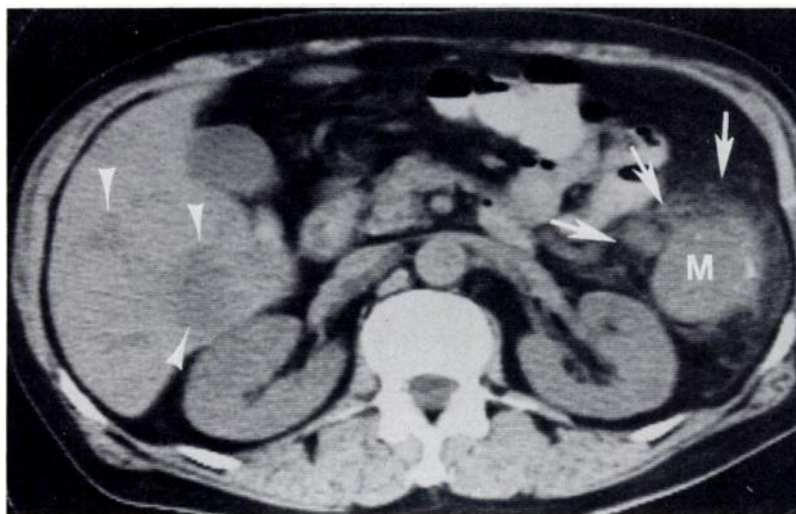
**Figure 12**

**Mesenteric edema** There is a generalized increase in the attenuation of the mesenteric fat, M, as compared to the retroperitoneal fat (curved arrow). The edema was secondary to hypoalbuminemia. The margins of the mesenteric vessels (arrow) are indistinct; this is indicative of perivascular edema.

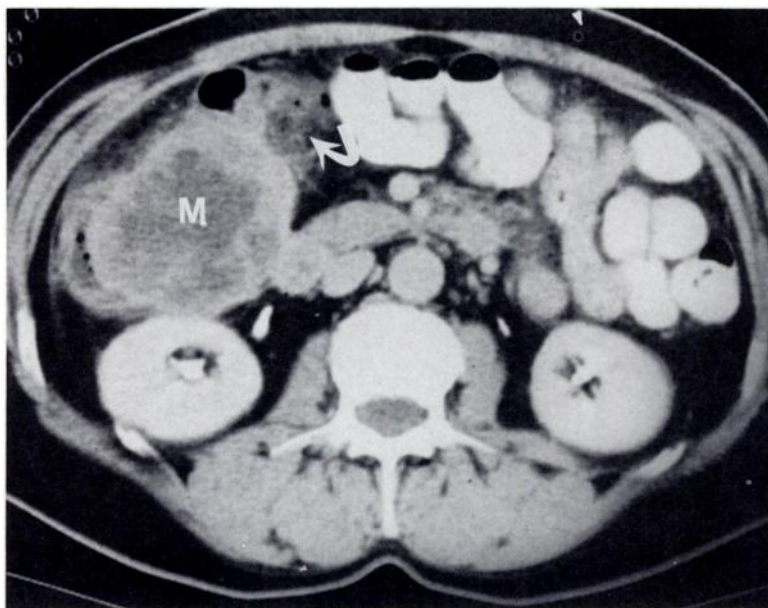


## PRIMARY CARCINOMA

In those neoplasms with direct extension into the mesentery (Figures 13 and 14), the most common feature was an ill defined soft tissue mass extending into the fat. Although CT is not the primary modality for evaluating colonic tumors, it provides staging information by defining tumor beyond the wall (18). CT also provides a technique for assessing recurrence and planning radiation therapy (19).

**Figure 13**

**Primary adenocarcinoma of the descending colon** A soft tissue mass is noted in the descending colon, M. The ill defined opacities (arrows) in the adjacent mesenteric fat represent direct tumor extension secondary to local bowel perforation. Also noted are multiple liver metastases (arrowheads).

**Figure 14**

**Colon carcinoma** This section shows a large exophytic, partially necrotic tumor mass, M, in the ascending colon. The lesion extends into the surrounding mesentery (curved arrow).

## METASTATIC NEOPLASMS

Carcinoid tumor evokes an intense fibrotic reaction within the mesentery. The CT appearance is that of a mass within radiating opacities representing thickened neurovascular bundles (Figure 15). This creates the classic findings on barium study, including fixation, narrowing, and separation of bowel loops. Although CT is poor for defining the primary tumor, retroperitoneal adenopathy may be identified in 39% and liver metastases in 65% of carcinoid tumors (20).

Peritoneal mesothelioma is a rare tumor of the membranes of the abdominal cavity. Barium studies may show bowel fixation and obstruction, but they cannot image the tumor. CT findings include: ascites, peritoneal and omental nodules, and a thickened, rigid mesentery (Figure 16). Diffuse metastatic disease is identified by thickening and nodularity along the mesentery (Figures 17, 18 and 19).

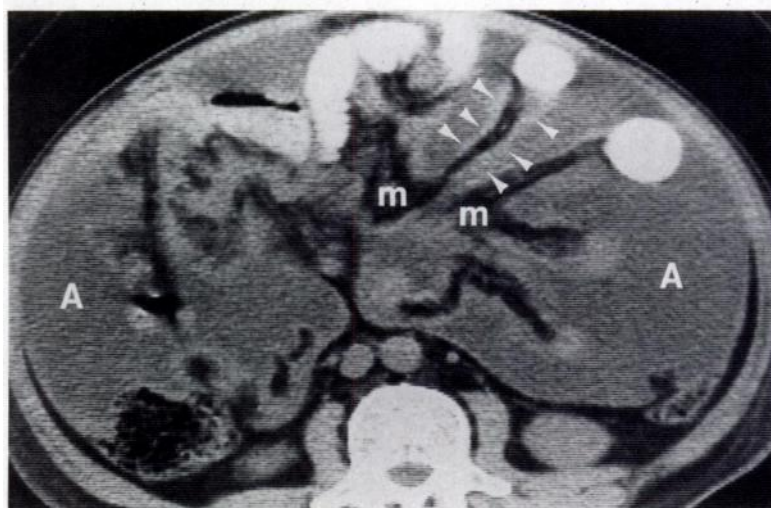
**Figure 15**

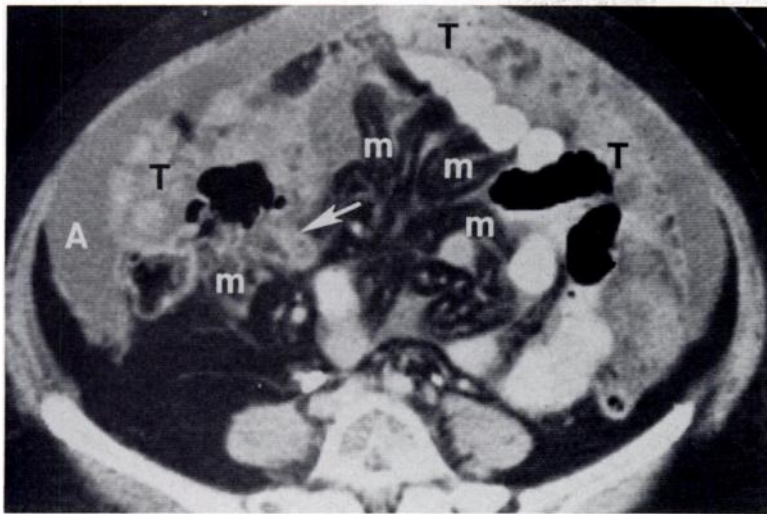
**Carcinoid tumor** In this section, the focal tumor (arrow) has caused retraction of the mesentery and mesenteric vasculature, producing the multiple linear radiating opacities that extend from the mass.



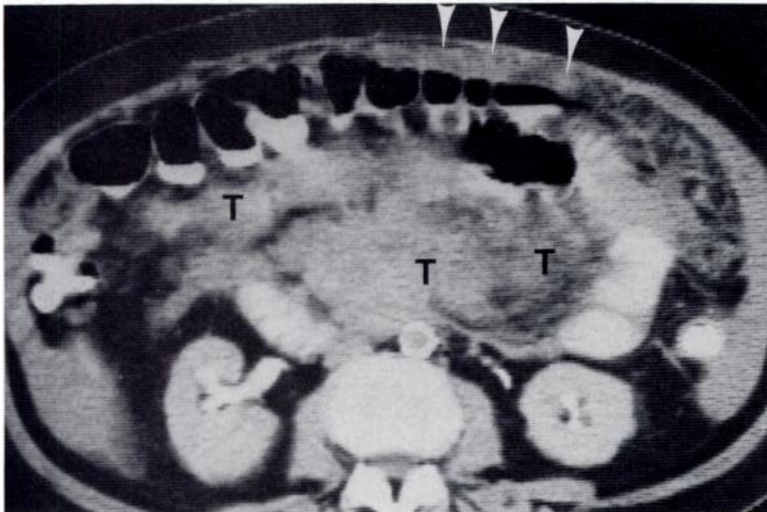
**Figure 16**

**Malignant mesothelioma** This section shows extensive ascites, A, and there is thickening of the mesenteric leaves (arrowheads), which are fixed in the abdominal cavity. Centrally, within the fat of each of the mesenteric leaves, is a thin linear structure representing the accompanying mesenteric vessels, (m).

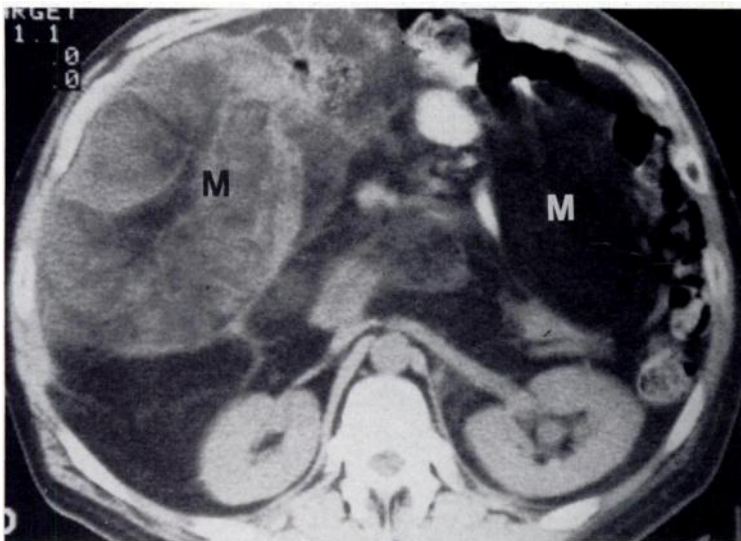




**Figure 17**  
**Metastatic disease** Multiple nodular implants from metastatic breast carcinoma and associated ascites, A, are noted in the greater omentum, T. In addition, tumor is infiltrating the mesentery diffusely (arrow) producing thickening and separation of the mesenteric leaves, M.



**Figure 18**  
**Metastatic pancreatic carcinoma** The mesentery is diffusely infiltrated with tumor. The presence of omental (arrowheads) and mesenteric tumor, T, was confirmed surgically.



**Figure 19**  
**Metastatic liposarcoma** Multiple masses of fatty and soft tissue attenuation, M, distort the abdominal cavity and displace bowel loops and mesenteric vessels.

## Conclusions

Various inflammatory, edematous, and neoplastic processes may directly affect the mesentery. CT provides the most accurate method for directly imaging these abnormalities.

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