17. Radiology of peritoneal carcinomatosis

Ann G. Archer, Paul H. Sugarbaker, and James S. Jelinek

Introduction

Radiologic evaluation of the liver, lungs, and retroperitoneum to detect primary or recurrent cancer has been shown to achieve great accuracy. Computed tomography (CT) will reliably detect lesions of 1 cm diameter in all these locations. Special studies can make the CT even more sensitive with some loss of specificity. Within the abdomen and pelvis, the accuracy of CT examination markedly diminishes. The size threshold for reliable (90%) lesion detection increases to several centimeters in some disease states. The tumor biology of cancer dissemination on abdominopelvic surfaces differs considerably from the dissemination that occurs through lymphatic channels or through the bloodstream. In this chapter we attempt to use the natural history of peritoneal carcinomatosis and sarcomatosis to assist in the interpretation of radiologic findings. Also, unique radiologic features of mucinous adenocarcinoma, adenocarcinoma, and sarcoma dissemination on abdominal and pelvic surfaces are illustrated. A search for a new level of understanding of abdominal and pelvic CT in patients with peritoneal carcinomatosis or sarcomatosis is sought.

Radiologic evaluation of spread of intraperitoneal tumor

As surgical techniques have improved and the oncology community realizes the potential for treatment of recurrent gastrointestinal cancer, the detection of peritoneal carcinomatosis for planning surgical procedures and for postoperative surveillance of recurrence becomes increasingly important. Historically all imaging modalities have been used for the detection of peritoneal tumor. These include plain film, ultrasound, magnetic resonance imaging, and CT. However, CT scan of the abdomen and pelvis with oral and intrarectal contrast plus intravenous contrast is the state-of-the-art imaging modality for detection of peritoneal tumor. Ultrasound is one of the easiest and most cost-effective mechanisms for detecting ascites within the abdomen. Yeh in 1979 evaluated the sonographic
appearance of peritoneal tumor [1]. His descriptions included ascitic fluid with a nodular configuration, with progressive coalescence into sheets of tumor encasing the peritoneal surfaces. Seshall and Coulam described scalloping of the liver due to extrinsic pressure by adjacent peritoneal implants [2]. The ascitic fluid with mucinous cancer also contained separations associated with nodularity. Simple ascites of the abdomen may rarely have septation but should not demonstrate nodularity. Unfortunately, ultrasound has little accuracy in detecting smaller implants of tumor adjacent to bowel, or when the tumor is more solid with less ascitic fluid.

In the mid-1980s, the CT findings of peritoneal carcinomatosis were reviewed [3–10]. The peritoneal tumors included ovarian carcinoma, appendiceal carcinoma, undifferentiated carcinomas, and mixed sarcomas. CT showed that the attenuation of the malignant ascites was similar to that of transudative ascites, but of a slightly higher density. In addition, scalloping of the liver margins, irregularity of the abdominal wall, or displacement of bowel loops due to extensive pressure of peritoneal tumor could be seen [11]. The poorly defined septations seen better by ultrasound were less well seen by CT. Occasional mucinous nodules had rimlike calcification. Nodules ranging in size from 1.5 to 3.5 cm were identified along the lateral aspect of the liver and in the anterior and lateral margins of the peritoneum. They are rarely appreciated on visceral peritoneal surfaces. Other findings in addition to ascites included mesenteric masses, pelvic masses, and other manifestations of cancer invasion, including periaortic adenopathy, hepatic metastasis, hydronephrosis, and focal obstruction of bowel loops [12]. Jeffery emphasized the importance of adequate oral contrast to opacify the bowel [3]. This served to decrease the false-positive diagnosis of tumor, which later was shown to represent unopacified bowel. The realization that CT had a low sensitivity was clearly documented.

In 1988, Walkey et al. reviewed 73 abdominal and pelvic CT scans in 60 patients with peritoneal tumor [9]. The most common findings included ascites (74%), parietal peritoneal thickening and enhancement (62%), small bowel involvement (50%), and loculation of ascitic fluid with absence of fluid in the cul-de-sac (17%). Seeding of tumor also resulted in tumor nodules, omental caking, and soft tissue penetration of fat. The tumor nodules on the parietal peritoneal surfaces were best seen in the presence of ascites. Visualization of peritoneal masses was heavily dependent upon optional contrast enhancement of small bowel, which was also aided by inherent mesenteric and omental fat. Other findings included scalloping of the liver margins by adjacent peritoneal tumor, cystic masses, and low attenuation masses displacing bowel.

Hughes et al. discussed the distinguishing features between intrahepatic and extrahepatic malignancies [11]. As peritoneal tumors beneath the hemidiaphragms create a defect within the soft hepatic parenchyma, it is