Review

Biliopancreatic malignancy current diagnostic possibilities: An overview

J.T. Ferrucci
Department of Radiology, Boston University School of Medicine, Boston, MA, USA

Summary

Modern imaging of pancreatic cancer remains a daily challenge both for detection and staging. Helical CT scanning, MRI, and more recently endoscopic ultrasound (EUS) all contribute. Demonstration of local vascular anatomy for assessing resectability is increasingly performed by non-invasive methods such as CT and MR angiography avoiding the need for traditional catheter angiograms. While a variety of primary tumors can occur in the pancreas ductal adenocarcinoma is by far the most important clinically accounting for c.80% of pancreatic neoplasms. Moreover, cancer of the pancreas presents more frequent and complex diagnostic imaging problems than carcinomas of the biliary tract and will form the focus of this discussion.

Key words: CT scanning, magnetic resonance, pancreatic cancer

Imaging tasks

The clinical challenges in pancreatic cancer imaging include detection of early or "minimal" cancers while a chance for curative surgical resection remains. Despite the dismal prognosis for most pancreatic cancer patients, modern aggressive surgical techniques (Whipple procedure) and post-operative radiation therapy may result in surprisingly good survivals (20-30% five year) in selected subgroups with early or "minimal" disease. The term "minimal" lesions refers to tumors 1-2 cm in diameter which do not form a mass effect or contour bulge of the pancreatic margin and are generally located largely within the intraglandular parenchyma of the pancreas. Recognition of unusual malignancies, such as mucinous duct ectasia and cystadenocarcinoma and differentiation of chronic pancreatitis from an underlying carcinoma are further important difficult clinical problems. Once carcinoma is suspected or confirmed, preoperative staging for assessment of resectability is a final critical issue.

Imaging techniques

Modern pancreatic imaging approaches utilize US, CT and MRI. US is often employed as an initial screening technique, but either CT or MR is usually performed in the course of definitive evaluation. Both techniques benefit from administration of intravenous contrast agents and both are able to demonstrate small intrapancreatic lesions in the order of 2cm in diameter. Both methods show tumor to be hypoenhancing relative to normal pancreatic parenchyma. In addition, both methods readily disclose dilatation of pancreatic and biliary duct systems, common although not specific signs of malignancy. The introduction of helical CT has improved the ability to image the biliary tract and pancreas allowing the rapid acquisition of a volume of data capable of imaging all portions of the ductal system. Previously, non-helical CT scanners acquired data in separate slices during repetitive breath-hold acquisitions which led to the risk of portions of the anatomy being excluded from the images. The use of helical CT permits the acquisition of a larger volume of tissue in a single breath-hold period. In addition, the use of a helical technique allows retrospective reconstruction of images with variable slice overlap. This post-processing of data has let to an increase in the diagnostic accuracy of CT.

Current techniques for imaging of the biliary tract and pancreas require the use of spiral acquisition with thin collimation (3-5mm), 20-40% reconstruction overlap, pitch of 1.0-1.5 and use of both conventional and narrow image display window widths. The use of oral contrast material and intravenous contrast material depends on the suspected disease entity under study. CT imaging is carried out with iodinated contrast agents, while MR uses T1 weighted fat suppressed sequences with both gadolinium and a newer contrast agent manganese DpDp (mangofodipir). Modern CT scanning techniques use helical scanning with dual phase data acquisition (arterial phase for pancreatic arterial imaging and portal phase for venous abnormalities) [1,2]. Accuracy for detecting pancreatic neoplasms has been enhanced by these newer CT technologies [3,4]. Although contrast enhanced helical CT gives high accuracy for pancreatic cancer detection, MRI also performs well. Several recent studies using dynamic gadolinium enhancement with T1 weighted fat suppressed images have shown excellent results [5]. Nonetheless, with both CT and MR many imaging findings are not specific to cancer and can occur in chronic pancreatitis, e.g., mass, duct dilatation, necrosis and cyst formation, and peripancreatic vascular involvement. Thus, needle biopsy is often carried out most often under CT or US guidance.
Assessment of peripancreatic and venous anatomy utilizing CT or MR angiography and venography are now established techniques. Computer assisted image processing using maximum intensity projection (MIP) and shaded surface display (SSD) reconstructions has greatly reduced the need for traditional celiac and superior mesenteric angiography [4,6]. Endoscopic ultrasound is increasingly used for high resolution imaging and is accurate in detecting 1-2cm intrapancreatic masses as hypoechoic lesions [7]. Even intraductal tumor nodules can be demonstrated with this technique. This method also enables guided fine needle aspiration biopsy for tissue confirmation. Present results indicate EUS and helical CT to provide equal accuracy in detecting pancreatic cancers. EUS remains more costly and less available. Few imaging methods have been consistently successful at distinguishing the mass effect of chronic pancreatitis from carcinoma, although radionuclide PET scanning using F18 fluorodeoxy glucose has been the subject of recent studies. PET scanning is also of use for follow-up of recurrent disease, especially after pancreaticoduodenectomy [8].

Assessing resectability

Preoperative staging of pancreatic carcinoma for resectability centers on evidence of extrapancreatic extension. CT scanning has been the traditional technique, especially for demonstration of liver metastases, regional lymph node and vascular invasion. Peritoneal implants are more accurately demonstrated by laparoscopy. Helical CT and/or MR after intravenous contrast accuracy demonstrate involvement of the celiac and superior mesenteric arteries, as well as the portal and superior mesenteric veins [1,4,6]. Vascular contact, stenosis with encasement and frank occlusion are well demonstrated by both techniques. Dilated peri-pancreatic splanchronic veins are important sequelae of mesenteric and portal vein occlusion. Helical CT with 3D CT angiography displays narrowed vessels in coronal as well as sagittal planes easily recognizable by the pancreatic surgeon [4]. In addition, anatomic conditions relevant for surgical manipulations intraoperatively are well demonstrated, including replaced right hepatic artery and proximal arterio sclerotic stenosis of the celiac or superior mesenteric arteries which appear frequently in the age group affected by pancreatic adenocarcinoma.

References