Imaging of the Pancreas

Ming-ming Xu, MD, Amrita Sethi, MD*

KEYWORDS

- Contrast-enhanced harmonic endoscopic ultrasound • Endoscopic ultrasound
- Elastography • Intraductal pancreatic mucinous neoplasm
- Mucinous cystic neoplasm • Probe-based confocal endomicroscopy
- Serous cystic neoplasm

KEY POINTS

- Preoperative imaging of the pancreas has become a critical part of the evaluation, diagnosis, and staging of pancreatic cancer and other pancreatic neoplasms.
- Endoscopic ultrasound scan is associated with higher sensitivities for diagnosing pancreatic solid lesions and cystic lesions compared with cross-section imaging with MRI or multidetector computed tomography.
- New advances in endoscopic ultrasound scan enhancement with elastography and contrast enhancement may provide improvement in distinguishing malignant from benign inflammatory pancreatic diseases.

INTRODUCTION

Pancreatic mass lesions are highly concerning for pancreatic cancer, which remains highly fatal cancer and the fourth leading cause of cancer-related deaths. The American Cancer Society estimates 48,960 new cases of pancreatic cancer diagnosed in 2015 with an almost equal number of cancer-related deaths.[1] Preoperative imaging of the pancreas has become a critical part of the evaluation, diagnosis, and staging of pancreatic cancer and other pancreatic neoplasms. Early and accurate detection and staging of pancreatic neoplasms allows for curative resection in select patients, and avoidance of surgery in those who would not benefit and in whom further workup is indicated.

With the increased use of cross-sectional imaging, incidentally discovered pancreatic cysts have also become a common clinical problem. An estimated 15% of patients undergoing MRI of the abdomen are found to have a pancreatic cyst.[2] Although cystic neoplasms of the pancreas only account for 1% to 5% of all malignant

Disclosures: Boston Scientific-Consultant, Mauna Kea Technologies-travel reimbursement (A. Sethi).

Division of Digestive and Liver Disease, Columbia University Medical Center, 622 West 168th Street, New York, NY 10032, USA
* Corresponding author. 161 Fort Washington Avenue, Suite 852, Herbert Irving Pavilion, New York, NY 10032.
E-mail addresses: as3614@columbia.edu; as3614@cumc.columbia.edu

Gastroenterol Clin N Am 45 (2016) 101–116
http://dx.doi.org/10.1016/j.gtc.2015.10.010 **gastro.theclinics.com**
0889-8553/16/$ – see front matter

pancreatic neoplasms, they generate a substantial volume of subsequent imaging and procedures to differentiate between benign and malignant lesions. This imaging, in turn, has led to advances in radiologic and endoscopic-based imaging studies to better characterize the nature of these cysts. This report reviews the range of imaging tools currently available to evaluate pancreatic lesions, from solid tumors to pancreatic cysts. This article reviews noninvasive radiologic imaging and moves to the evolving role of endoscopic ultrasound scan (EUS) and the newer techniques of elastography and contrast-enhanced EUS. Finally, recent device innovations moving the field toward in vivo endoscopic microscopy of the pancreas are discussed.

RADIOLOGIC IMAGING OF THE PANCREAS

Solid Pancreatic Lesions

The most common etiology of a solid pancreatic tumor is adenocarcinoma, which accounts for 85% to 95% of all pancreatic tumors.[3] A few other malignant pancreatic neoplasms in the differential diagnosis of a solid pancreatic tumor have a generally more favorable prognosis compared with adenocarcinoma (**Box 1**). Noninvasive cross-sectional imaging of the pancreas remains the first-line imaging modality of choice in the evaluation of a pancreatic mass (**Table 1**). Cross-sectional studies can provide a general assessment of malignancy potential, resectability, presence of lymphadenopathy, and distant metastases.

Dual-phase multidetector computed tomography (MDCT) is an excellent initial imaging choice in the evaluation of pancreatic masses and is often referred to as *pancreatic protocol computed tomography* (CT). It provides 1-mm thick cross-sectional images of the pancreas with volume acquisition and allows for 3-dimensional reconstruction and vascular mapping in multiplanar views.[10] The dual contrast phase obtains images of the pancreatic parenchyma during the arterial phase and peripancreatic vasculature during the portal venous phase. Most pancreatic masses are hypoattenuating and best visualized during the portal venous phase, although certain neuroendocrine tumors and metastatic deposits to the pancreas can be hypervascular.[10] Signs used on MDCT to detect a small pancreatic mass even when no overt lesion is visible include concurrent biliary and pancreatic ductal dilation or "double duct" sign for pancreatic head tumors, subtle changes in the contour of the pancreas, or loss of perivascular fat planes.[11,12] In a head-to-head prospective comparison of the diagnostic yield of MDCT to EUS, DeWitt and colleagues[4] found MDCT to have lower sensitivity of overall cancer detection (86% vs 98% for EUS, $P = .01$), but MDCT was equivalent to EUS for tumor nodal staging. Although CT imaging overall has a high positive predictive value of more than 90% for tumor detection,[13,14] it is limited by poor detection of small tumors, critically those tumors in the early resectable stage, small hepatic metastases, and peritoneal implants.[15,16]

Box 1
Differential diagnosis of solid pancreatic tumors

- Pancreatic adenocarcinoma
- Pancreatic neuroendocrine tumor
- Pancreatoblastoma
- Pancreatic lymphoma
- Solid pseudopapillary tumor