Pancreatic Solid and Cystic Neoplasms
Diagnostic Evaluation and Intervention

Mahmoud M. Al-Hawary, MD[a,*], Isaac R. Francis, MD[b], Michelle A. Anderson, MD, MSc[c]

KEYWORDS

• Pancreas • Neoplasms • Solid • Cystic • Imaging • Intervention

KEY POINTS

- Typical imaging techniques for the evaluation of pancreatic neoplasms include computed tomography, MR imaging, and, in selected cases, endoscopic ultrasound.
- High-quality dedicated imaging is essential for the diagnosis and assessment of pancreatic tumor extent, both of which are required to determine the best therapy for patients.
- Endoscopic ultrasound facilitates tissue or cyst fluid sampling in solid and cystic pancreatic neoplasms to help establish the diagnosis or narrow the differential diagnosis.
- The mainstay of treatment of pancreatic neoplasms is complete surgical resection when possible.
- Several noninvasive and invasive methods for treating solid and cystic pancreatic neoplasms are being investigated when surgery is not possible or is contraindicated.

INTRODUCTION

Malignant pancreatic neoplasms are usually aggressive tumors with high mortality rates mainly attributed to the high prevalence of advanced disease at presentation and to the lack of significant advancement in medical therapies over the recent decades. The mainstay of curative treatment in most malignant pancreatic neoplasms depends on complete R0 surgical resection of the tumor (ie, no microscopic residual disease following resection) when possible. Focal ablation therapies are increasingly used in locally advanced tumors, unresectable tumors, or in poor surgical candidates and are mainly aimed at pain palliation and potentially improved survival. Common solid pancreatic neoplasms include pancreatic ductal adenocarcinoma (PDA) and pancreatic neuroendocrine tumor (NET). Common premalignant and malignant cystic pancreatic neoplasms include intraductal papillary mucinous neoplasm (IPMN) and mucinous cystic neoplasm (MCN). The incidence and rate of detection of common pancreatic solid and cystic lesions has been increasing in recent years.[1–3] The increase in detection rates is at least in part caused by the improvement in resolution of the imaging modalities, overall increased utilization of imaging for other indications, and an increased awareness of cystic pancreatic neoplasms. Commonly used imaging techniques and protocols, imaging findings, and available

Disclosures: None.

[a] Division of Abdominal Imaging, Department of Radiology, University of Michigan Hospitals, 1500 East Medical Center Drive, Room B1 D502, Ann Arbor, MI 48109, USA; [b] Division of Abdominal Imaging, Department of Radiology, University of Michigan Hospitals, 1500 East Medical Center Drive, Room B1 D540, Ann Arbor, MI 48109, USA; [c] Division of Gastroenterology, Department of Internal Medicine, University of Michigan Hospitals, 1500 East Medical Center Drive, Ann Arbor, MI 48109, USA
* Corresponding author.
E-mail address: alhawary@med.umich.edu

Radiol Clin N Am 53 (2015) 1037–1048
http://dx.doi.org/10.1016/j.rcl.2015.05.005
0033-8389/15/$ – see front matter

interventions and therapies of common solid and cystic pancreatic neoplasms are discussed in this article.

IMAGING TECHNIQUES AND PROTOCOLS

Computed Tomography

Thin-section multiphasic multidetector computed tomography (MDCT) of the abdomen is the most commonly used imaging tool in the evaluation of known or suspected pancreatic lesions.[4–6] CT utilization is primarily driven by the wider availability of CT scanners (compared with MR imaging) and the familiarity of interpreting radiologists with the imaging findings on CT (**Fig. 1**). The scan protocol outlined (**Table 1**) makes optimal use of both oral and intravenous contrast material with acquisition parameters that improve focal pancreatic mass detection, focal pancreatic mass extent, and the identification of metastatic disease. The small slice thickness helps achieve the highest spatial resolution possible to optimize visualization and to allow the identification of fine details, such as small focal lesion detection, pancreatic duct dilatation, pancreatic duct communication, tumor-to-vascular relationships, and alteration in vascular contour (**Fig. 2**). The use of neutral oral contrast material (such as water or other similar-density oral contrast agents) removes the uncommon artifacts caused by high-density oral contrast material and the masking effect of positive oral contrast that can hinder the volumetric reconstruction of the acquired images. Oral contrast also ensures distension of the adjacent stomach and duodenum, potentially improving the detection of local invasion. Selecting an intravenous low-osmolality iodinated contrast agent with a higher iodine concentration (eg, 370 mg Iodine/mL) helps to distinguish hyperenhancing or hypoenhancing lesions from the surrounding pancreatic parenchyma and improves the delineation of the peripancreatic vascular structures (**Fig. 3**). The reduced volume of intravenous contrast material in combination with reduced scan kilovolts peak settings (100–120 kVp or less) has been shown to increase the attenuation of iodinated contrast material without degrading the diagnostic imaging quality.[7,8] The dual-phase acquisition in the pancreatic parenchymal and subsequently the portal venous phase ensures optimal enhancement of the pancreatic parenchyma and adjacent arteries on the pancreatic phase and optimal enhancement of the remaining solid abdominal organs—most importantly the liver and peripancreatic veins—during the portal phase. Split bolus single-acquisition MDCT with spectral imaging at different kiloelectron volts has been shown to be at least equal to dual-phase single-energy CT in the assessment of vascular, liver, and pancreatic attenuation and tumor conspicuity, with a reduction in the radiation dose to the patients.[9] Scan coverage can be extended to cover the pelvic region with or without the thorax for complete assessment of metastatic disease or other incidental abnormalities that may influence treatment. Such additional staging scans are usually obtained based on institutional preferences, national guidelines, and scan indications.

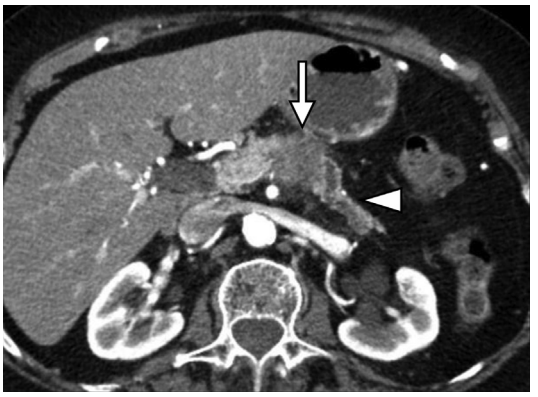

Fig. 1. Pancreatic adenocarcinoma on MDCT. Axial MDCT image through the pancreas demonstrates a focal hypodense lesion in the proximal pancreatic body (*arrow*) with associated atrophy of the pancreatic parenchyma and concomitant dilatation of the pancreatic duct in the distal body/tail region (*arrowhead*).

CT reconstruction algorithms are essential for optimizing the review of the acquired thin-section MDCT images to facilitate the assessment of the pancreas and the surrounding vascular structures (**Table 2**). These algorithms depend on the slice thickness used in the acquisition, the availability of dedicated image review stations, and a volumetric image reconstruction client capable of generating high-fidelity multi-planar, maximum-intensity projections and 3-dimensional (3D) volumetric images.

MR Imaging

Contrast-enhanced MR imaging and contrast-enhanced magnetic resonance cholangiopancreatography (MRCP) of the abdomen have been shown to be of equal diagnostic accuracy to contrast-enhanced MDCT for the staging of solid pancreatic neoplasms and can be used interchangeably with MDCT depending on local practice preferences[5,10,11] (**Fig. 4**). However, MRCP is superior to CT for the evaluation of cystic pancreatic lesions given its improved signal-to-noise ratio