Cystic Pancreatic Tumors

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KEYWORDS

• Cystic pancreatic neoplasm • Intraductal papillary mucinous neoplasm • Serous cystadenoma • Mucinous cystadenoma and cystadenocarcinoma • Solid pseudopapillary tumor

KEY POINTS

- Cystic pancreatic lesions are common and often incidentally detected. Correct identification of lesions by clinical history and imaging, and differentiation of benign from malignant neoplasms are critical.
- With its superior soft tissue contrast and multi-parametric nature, MR imaging/magnetic resonance cholangiopancreatography is an ideal single imaging modality for complete characterization of cystic pancreatic lesions. Other imaging modalities can offer additional, specific information, including multi-detector computed tomography for detection of calcification, PET for metabolic assessment, and endoscopic ultrasound for fluid and tissue sampling.
- Main-duct intraductal papillary mucinous neoplasms, mucinous cystic neoplasms, and solid pseudopapillary tumors all carry significant risk for malignant degeneration and, in amenable patients, are typically immediately resected.
- The appropriate follow-up/screening algorithm for cystic pancreatic lesions has undergone multiple revisions in the last few years. The most up-to-date recommendations incorporate lesion size, communication with the main pancreatic duct, and age of patients at the initial presentation.

INTRODUCTION

Cystic pancreatic lesions are common, present in 2.5% of the population[1] and incidentally detected on 2.2% of computed tomography (CT) examinations of the abdomen and pelvis and up to 19.6% of MR imaging examinations of the abdomen.[2] Most lesions, on the order of 70%, are asymptomatic, and most are benign. However, some of these benign lesions have malignant potential as high as 68%[3]; therefore, correct identification, complete characterization, and adequate follow-up/management of these lesions are paramount.

This review addresses the most common imaging modalities used for the evaluation of cystic pancreatic lesions, with a focus on MR imaging. Following this is a discussion of the epidemiology, pathology, and imaging characteristics of the most common cystic pancreatic neoplasms, including intraductal papillary mucinous neoplasm (IPMN), serous cystic neoplasm (SCN), mucinous cystic neoplasm (MCN), and solid pseudopapillary tumor (SPT), and a brief discussion of other causes of cystic pancreatic lesions, including cystic degeneration of solid malignant masses, pancreatitis-related pseudocysts, and pancreatic cysts associated with systemic disease. Finally, the authors conclude with a discussion about how to follow cystic pancreatic lesions, incorporating the most up-to-date guideline recommendations.

IMAGING MODALITIES USED TO EVALUATE CYSTIC PANCREATIC LESIONS

Because most pancreatic cystic lesions are asymptomatic, they are most often found incidentally on cross-sectional CT or MR imaging studies. Occasionally a cystic lesion may be found by transabdominal ultrasound in the pancreatic head or neck, though evaluation of the body and tail is often limited by overlying bowel gas. This limitation also decreases the utility of transabdominal ultrasound for lesion characterization and

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follow-up.[4] The major modalities used for cystic pancreatic lesion characterization are multidetector CT (MDCT), MR imaging/magnetic resonance cholangiopancreatography (MRCP), and endoscopic ultrasound (EUS) with or without cyst fluid sampling, with PET/CT being reserved for select cases. For pancreatic cyst follow-up, in which a less invasive examination is preferred, MDCT and MR imaging/MRCP are most commonly used. Technical considerations, strengths, and weakness of each modality are presented here.

MR Imaging/Magnetic Resonance Cholangiopancreatography

The multi-parametric nature of MR imaging/MRCP examinations allows for complete characterization of cystic pancreatic lesions. The pancreas MR imaging protocol used for lesion characterization at the authors' institution includes in- and out-of-phase gradient echo sequences, postcontrast images in multiple phases of contrast enhancement, and thick slab and 3-dimensional (3D) MRCP sequences, as shown on the left in **Table 1**.[5] Once the cystic lesion is fully characterized, an abbreviated protocol can be considered for subsequent follow-up examinations, as shown on the right in **Table 1**.[6] Advanced MRCP techniques may incorporate negative oral contrast and/or secretin stimulation of the exocrine cells to further aid with more nuanced characterization of particular cystic pancreatic pathologies, such as IPMN and pseudocyst,[7,8] though these are often not necessary for initial lesion characterization.

MR imaging/MRCP offers a few general advantages over MDCT evaluation, including a lack of ionizing radiation exposure; superior evaluation of the pancreatic ductal system allowing characterization of complex fistulous connections between cystic lesions and surrounding structures, as seen in **Fig. 1**; and superior characterization of cyst morphology, including detection of septa and solid nodular components, as described in **Table 2**. General disadvantages of MR imaging/MRCP include the high cost of the examination, poorer temporal resolution, patient cooperation, and limited evaluation of calcification.[5]

Other Imaging Modalities

A multi-phase pancreatic protocol including arterial (30 seconds), pancreatic parenchymal (45 seconds), and portal venous (70 seconds) phases of contrast enhancement can be used to characterize cystic pancreatic lesions. Dose reduction techniques to consider include limiting the field of view to the abdomen and use of a dual-energy CT scanner with creation of virtual noncontrast, monochromatic low-kilovolt multiparametric and virtual iodine map reconstructions.[9–13] With this protocol, MDCT has a few advantages over MR imaging/MRCP, namely, temporal resolution, lower cost, greater availability, and a better ability to see calcifications.[5] However, the radiation involved and renal and allergic risks associated with iodinated contrast have led to MR imaging/MRCP being the more frequently used examination.[14]

EUS can also be used for characterization of cystic pancreatic lesions. Although it performs similarly to MR imaging/MRCP for detection of septa, solid nodules, and main pancreatic ductal dilatation, it is relatively limited in its assessment of main pancreatic ductal communication and

Table 1
Complete and abbreviated MR imaging/magnetic resonance cholangiopancreatography protocols

Complete MR Imaging/MRCP Protocol	Abbreviated MR Imaging/MRCP Protocol
Axial T2 FSE ± fat suppression	Axial T2 FSE ± fat suppression
Coronal T2 FSE ± fat suppression	Coronal T2 FSE ± fat suppression
Axial T1 in-phase and opposed-phase GRE	Axial 3D T1 fat-suppressed spoiled GRE
Axial diffusion-weighted imaging	Axial diffusion-weighted imaging
Axial 3D T1 fat-suppressed spoiled GRE	Coronal thick slab T2-weighted MRCP
Axial T1 post–pancreatic phase	Coronal 3D T2-weighted MRCP
Axial T1 post–portal venous phase	
Axial T1 post–equilibrium/delayed phase	
Coronal thick slab T2-weighted MRCP	
Coronal 3D T2-weighted MRCP	

Abbreviations: FSE, fast spin echo; GRE, gradient echo.