The Many Faces of Pancreatic Serous Cystadenoma: Radiologic and Pathologic Correlation

Poster No.: C-1026
Congress: ECR 2012
Type: Educational Exhibit
Authors: L. Chu, A. D. Singhi, R. H. Hruban, C. L. Wolfgang, B. H. Edil, R. D. Schulick, J. L. Cameron, E. K. Fishman; Baltimore, MD/US
Keywords: Neoplasia, Diagnostic procedure, CT, Pancreas
DOI: 10.1594/ecr2012/C-1026

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS by third parties in the form of scientific presentations. References to any names, marks, products, or services of third parties or hypertext links to third-party sites or information are provided solely as a convenience to you and do not in any way constitute or imply ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR is not responsible for the content of these pages and does not make any representations regarding the content or accuracy of material in this file.

As per copyright regulations, any unauthorised use of the material or parts thereof as well as commercial reproduction or multiple distribution by any traditional or electronically based reproduction/publication method is strictly prohibited.

You agree to defend, indemnify, and hold ECR harmless from and against any and all claims, damages, costs, and expenses, including attorneys' fees, arising from or related to your use of these pages.

Please note: Links to movies, ppt slideshows and any other multimedia files are not available in the pdf version of presentations.

www.myESR.org
Learning objectives

1) Illustrate the spectrum of CT appearances of serous cystadenomas with radiologic and pathologic correlation

2) Review the differential diagnosis of pancreatic masses that may mimic serous cystadenomas

3) Review key CT features that differentiate serous cystadenomas from other cystic and solid pancreatic masses

4) Review management of cystic pancreatic masses with literature based guidelines
Background

Pancreatic serous cystic neoplasms account for ~20% of primary cystic pancreatic neoplasms. Most serous cystic neoplasms are benign and represent serous cystadenomas [1]. Classically, pancreatic serous cystadenomas have been described as multiloculated cystic masses with central stellate scars and calcifications [2]. However, serous cystadenomas have a wide spectrum of CT appearances, ranging from unilocular cystic masses to hypervascular solid masses, which can mimic other benign and malignant pancreatic masses [3]. The purposes of this exhibit are to illustrate the spectrum of CT appearances of pancreatic serous cystadenomas with radiology and pathologic correlation and to review the differential diagnosis of pancreatic masses that may mimic serous cystadenomas.
Our Population

Between January 2003 and December 2010, 68 patients with surgically and pathologically proven pancreatic serous cystadenomas underwent preoperative CT. The CT examinations were performed on a 16-slice, 64-slice, or dual-source multidetector CT scanner using dual phase protocol (Table 1 on page 7). The CT findings were correlated with gross pathology photographs and histopathologic slides, which were obtained from the pathology archives.

Morphologic Patterns of Pancreatic Serous Cystadenomas

Pancreatic serous cystadenoma is a benign neoplasm composed of glycogen-rich epithelial cells that form innumerable small thin-walled cysts that contain serous fluid. Microscopically, the single layer of cuboidal or flattened cells lining the small cysts have round nuclei and abundant clear cytoplasm. Features of atypia or dysplasia are absent (Fig. 1 on page 7). These neoplasms have a predilection for middle aged and older women and are usually discovered incidentally [1]. The morphologic patterns of serous cystadenomas can be classified as microcystic, honeycomb, oligocystic, and solid patterns [3].

Microcystic Pattern

The microcystic or polycystic pattern, present in 70% cases of serous cystadenomas, consists of a collection of cysts (usually more than 6) that range from a few millimeters up to 2 cm in size. The presence of fine external lobulations is a common and characteristic feature (Fig. 2 on page 7). 30% of cases have fibrous central scars with or without stellate pattern of calcifications (Fig. 3 on page 8 and Fig. 4 on page 8), which are highly specific for serous cystadenomas [3, 4]. Serous cystadenomas typically do not communicate with the pancreatic duct (Fig. 5 on page 9). There have been only a few case reports describing serous cystadenomas with communication with the pancreatic duct [5, 6]. Aggressive features such as vascular invasion, mesenteric lymphadenopathy, and liver metastases are typically absent.

Honeycomb Pattern

The honeycomb pattern is seen in ~20% of cases, and consists of numerous tiny cysts that mimic a honeycomb or a sponge. These tiny cysts may be poorly depicted as individual cysts on CT. These serous cystadenomas appear as soft tissue or mixed attenuation masses depending on the size of the cysts and the amount of enhancing fibrous tissue (Fig. 6 on page 9 and Fig. 7 on page 14) [3, 4].
**Oligocystic Pattern**

The oligocystic pattern is seen in less than 10% of cases. It is composed of fewer but larger (> 2 cm) cysts and lacks the central stellate scar [1]. The presence of external lobulations and lack of communication with the main pancreatic duct are important defining features of oligocystic serous cystadenomas (Fig. 8 on page 15) [7]. Dilatation of the pancreatic duct can be seen in rare cases and may lead to the incorrect preoperative diagnosis of a mucinous cystic neoplasm or intraductal mucinous neoplasm (IPMN) (Fig. 9 on page 14).

**Solid Pattern**

Rare cases of solid variant of serous cystadenoma have been described. These serous cystadenomas do not contain any cystic spaces on histopathology and the cells are arranged in nests, sheets, and trabeculae separated by thick fibrous bands [8]. The stroma demonstrates avid contrast enhancement and accounts for the solid hypervascular appearance on CT (Fig. 10 on page 13). In other cases, the serous cystadenomas are not completely solid, but contain prominent stromal hyalinization with relatively few cystic components, which also impart the solid hypervascular configuration on CT (Fig. 11 on page 12). Serous cystadenomas may demonstrate intratumoral hemorrhage in rare cases (Fig. 12 on page 12) [9], which contributes to the high density solid appearance of these lesions.

**Aggressive Behavior of Atypical Serous Cystadenomas**

Rare cases of locally aggressive serous cystadenomas have been described, manifesting as tumors with direct invasion into large blood vessels, nerves, lymph nodes, and nearby structures (Fig. 10 on page 13 and Fig. 13 on page 11). These aggressive lesions do not exhibit cytologic or architectural atypia, and are histologically similar to typical serous cystadenomas. Large tumor size and location within the head of the pancreas are associated with aggressive behavior, and should be considered in the management of patients with serous cystadenomas.

**Summary of Typical and Atypical CT Features of Pancreatic Serous Cystadenomas**

**Typical CT Features**

- Cystic mass with lobulated external contour
- Presence of central stellate scar ± calcifications
- No communication with pancreatic duct
- No pancreatic parenchymal atrophy
• Absence of aggressive features (vascular invasion, lymphadenopathy, metastases)

Atypical CT Features

• Pancreatic parenchymal atrophy
• Dilatation of pancreatic duct
• Dilatation of common bile duct
• Vascular invasion
• Invasion of adjacent structures

Features Differentiating Serous Cystadenomas from other Cystic Pancreatic Masses

Other cystic pancreatic masses may mimic the CT appearance of the microcystic and oligocystic variants of pancreatic serous cystadenomas. Key distinguishing features of these mimickers are listed in Table 2 on page 10.

Features Differentiating Serous Cystadenomas from other Solid Pancreatic Masses

Other solid pancreatic masses may mimic the CT appearance of the solid and honeycomb variants of pancreatic serous cystadenomas. Key distinguishing features of these mimickers are listed in Table 3 on page 15.

Management of Pancreatic Serous Cystadenomas

Management of serous cystadenomas depends on patients’ age and comorbidities, tumor size and location, presence or absence of symptoms, local practice patterns, and surgeon preferences. If the diagnosis of serous cystadenoma can be made based on imaging and laboratory findings, surgical resection is usually reserved for symptomatic patients and patients with tumor > 4 cm in size regardless of symptoms. Follow-up imaging every 2 years is recommended for serous cystadenomas between 2 to 3 cm [10]. However, not all cases of serous cystadenomas demonstrate typical CT features and may remain indeterminate.
Table 1: Multidetector CT protocol for evaluation of pancreatic masses.

© Radiology, Johns Hopkins Hospital - Baltimore/US

<table>
<thead>
<tr>
<th></th>
<th>16-Slice Scanner</th>
<th>64-Slice Scanner</th>
<th>Dual Source Scanner</th>
</tr>
</thead>
<tbody>
<tr>
<td>kVp / Effective mAs</td>
<td>120 / 200-250</td>
<td>120 / 200-250</td>
<td>120 / 200-250</td>
</tr>
<tr>
<td>Rotation Time (s)</td>
<td>0.5</td>
<td>0.33</td>
<td>0.33</td>
</tr>
<tr>
<td>Detector Collimation (mm)</td>
<td>0.75</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Slice Thickness (mm)</td>
<td>0.75</td>
<td>0.75</td>
<td>0.75</td>
</tr>
<tr>
<td>Reconstruction Interval (mm)</td>
<td>0.5</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Oral Contrast</td>
<td>1000 mL Water</td>
<td>1000 mL Water</td>
<td>1000 mL Water</td>
</tr>
<tr>
<td>IV Contrast</td>
<td>2 mL/kg Iohexol</td>
<td>2 mL/kg Iohexol</td>
<td>2 mL/kg Iohexol</td>
</tr>
<tr>
<td>Injection Rate (mL/s)</td>
<td>3.0 – 4.0</td>
<td>3.0 – 4.0</td>
<td>3.0 – 4.0</td>
</tr>
<tr>
<td>Scan Delay – Arterial Phase (s)</td>
<td>25</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>Scan Delay – Venous Phase (s)</td>
<td>50 – 60</td>
<td>50 – 60</td>
<td>50 – 60</td>
</tr>
</tbody>
</table>

Fig. 1: Pancreatic serous cystadenoma. A) Gross pathology photograph shows numerous microcysts. B) Low power and C) High power histopathological slides show numerous tightly packed cysts lined by cuboidal tumor cells with clear cytoplasm and small round uniform nuclei.

© Radiology, Johns Hopkins Hospital - Baltimore/US
**Fig. 2:** 77 year old woman with a microcystic serous cystadenoma. A) Axial CT and B) gross pathology photograph show a microcystic mass within head of pancreas with numerous microcysts separated by thin internal septations.

© Radiology, Johns Hopkins Hospital - Baltimore/US

**Fig. 3:** 74 year old man with a microcystic serous cystadenoma. A) Axial CT and B) gross pathology photograph show a microcystic mass within tail of pancreas with characteristic central stellate scar and calcifications.

© Radiology, Johns Hopkins Hospital - Baltimore/US
Fig. 4: 73 year old man with a microcystic serous cystadenoma. A) Axial CT and B) gross pathology photo show a microcystic mass within tail of pancreas with characteristic fibrous central scar and calcifications (arrowheads).

© Radiology, Johns Hopkins Hospital - Baltimore/US

Fig. 5: 68 year old woman with a microcystic serous cystadenoma. A) Axial CT shows a polycystic mass within body of pancreas with the characteristic lobulated margin. B) Gross pathology photograph shows no communication between the cystic mass and the main pancreatic duct despite their physical proximity.

© Radiology, Johns Hopkins Hospital - Baltimore/US
Fig. 6: 46 year old woman with a honeycomb serous cystadenoma within body of pancreas. A) Axial CT shows lobulated spongiform mass with poor visualization of individual microcysts. B) Gross pathology photograph illustrates numerous microcysts in the honeycomb pattern.

© Radiology, Johns Hopkins Hospital - Baltimore/US
<table>
<thead>
<tr>
<th>Cystic Pancreatic Mass</th>
<th>Key Distinguishing Features</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudocyst</td>
<td>• Smooth external contour&lt;br&gt;• Peripancreatic stranding&lt;br&gt;• Clinical history of pancreatitis</td>
<td></td>
</tr>
<tr>
<td>Mucinous Cystic Neoplasm</td>
<td>• Smooth external contour [7]&lt;br&gt;• Relatively thick enhancing wall&lt;br&gt;• Peripheral calcifications [7]&lt;br&gt;• Thick septations/nodularity suggestive of malignancy</td>
<td><img src="image1.png" alt="Image" /></td>
</tr>
<tr>
<td>IPMN</td>
<td>• Pleomorphic and tubular external contour [7]&lt;br&gt;• Communication with main pancreatic duct or side branch [7]&lt;br&gt;• Thick septations/nodularity suggestive of malignancy</td>
<td><img src="image2.png" alt="Image" /></td>
</tr>
<tr>
<td>Cystic Neuroendocrine Neoplasm</td>
<td>• Presence of hypervascular halo&lt;br&gt;• Presence of liver metastases&lt;br&gt;• Clinical history of endocrinopathy (rare in cystic tumors)&lt;br&gt;• 25% association with MEN syndrome</td>
<td><img src="image3.png" alt="Image" /></td>
</tr>
<tr>
<td>Von Hippel Lindau</td>
<td>• Multiple pancreatic lesions, including cysts, serous cystadenomas, and neuroendocrine tumors&lt;br&gt;• Other signa of VHL: Renal cell carcinoma, pheochromocytoma, CNS and retinal hemangioblastomas</td>
<td><img src="image4.png" alt="Image" /></td>
</tr>
<tr>
<td>Lymphoepithelial Cyst</td>
<td>• Protrusion into peripancreatic soft tissues&lt;br&gt;• Typically no internal septations or few internal septations&lt;br&gt;• No central scar</td>
<td><img src="image5.png" alt="Image" /></td>
</tr>
</tbody>
</table>

**Table 2:** Features that differentiate serous cystadenomas from other cystic pancreatic masses.

© Radiology, Johns Hopkins Hospital - Baltimore/US
**Fig. 13:** 59 year old man with aggressive serous cystadenoma. A) Axial CT shows a heterogeneous cystic and solid mass within head of pancreas. There is atrophy of the body and tail of the pancreas with dilatation of the pancreatic duct (arrow) and intrahepatic bile duct (arrowhead) from mass effect. B) Histopathology slide shows extension of tumor (T) into a peripancreatic lymph node (LN).

© Radiology, Johns Hopkins Hospital - Baltimore/US

**Fig. 12:** 70 year old woman with a solid appearing serous cystadenoma. A) Axial CT shows hypervascular mass with lobulated margins within head of pancreas. B) Gross pathology photograph shows prominent stromal component and intratumoral hemorrhage, which account for its solid appearance on CT.

© Radiology, Johns Hopkins Hospital - Baltimore/US
Fig. 11: 44 year old woman with a solid appearing serous cystadenoma. A) Axial CT shows hypervascular mass with lobulated margins within head of pancreas (arrow). B) Gross pathology photograph shows prominent hyalinized stroma which corresponds to areas of avid contrast enhancement.

© Radiology, Johns Hopkins Hospital - Baltimore/US
**Fig. 10:** 69 year old man with solid variant of serous cystadenoma. A) Axial CT shows a hypervascular mass within tail of pancreas abutting the splenic hilum, with occlusion of the splenic vein (arrow). B) Gross pathology photograph shows solid mass within the pancreatic tail. C and D) Histopathology slides show solid sheets of tumor cells with absence of cystic spaces and presence of perineural invasion (arrowheads), unusual features for serous cystadenoma.

© Radiology, Johns Hopkins Hospital - Baltimore/US

**Fig. 7:** 73 year old woman with a honeycomb serous cystadenoma within head of pancreas. A) Axial CT shows lobulated spongiform mass. B) Gross pathology photograph illustrates honeycomb pattern of microcysts and central fibrous scar.

© Radiology, Johns Hopkins Hospital - Baltimore/US

**Fig. 9:** 48 year old man with an oligocystic serous cystadenoma. A) Axial CT shows a thin walled cystic mass within head of pancreas (arrow) with atrophy of the body and tail and dilatation of the pancreatic duct (arrowheads). B) Gross pathology photograph shows an oligocystic mass (arrow) causing obstruction of a dilated pancreatic duct (arrowheads).
Fig. 8: 18 year old woman with an oligocystic serous cystadenoma. A) Axial CT shows a thin walled cystic mass within tail of pancreas with minimally lobulated outer margin. B) Gross pathology photograph shows an oligocystic mass wrapping around a mildly dilated pancreatic duct without direct communication with the pancreatic duct (arrowheads).
<table>
<thead>
<tr>
<th>Solid Pancreatic Mass</th>
<th>Key Distinguishing Features</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adenocarcinoma</td>
<td>• Ill defined margins&lt;br&gt;• Vascular invasion&lt;br&gt;• Pancreatic duct dilatation and parenchymal atrophy&lt;br&gt;• Common bile duct dilatation&lt;br&gt;• Presence of liver metastases and lymphadenopathy</td>
<td><img src="image1" alt="Image" /></td>
</tr>
<tr>
<td>Neuroendocrine Neoplasm</td>
<td>• Typically hypervascular mass on arterial phase&lt;br&gt;• Clinical history of endocrinopathy&lt;br&gt;• Presence of liver metastases and lymphadenopathy</td>
<td><img src="image2" alt="Image" /></td>
</tr>
<tr>
<td>Solid Pseudopapillary Neoplasm</td>
<td>• Young women&lt;br&gt;• Cystic solid mass with thick tumor capsule&lt;br&gt;• Intratumoral hemorrhage</td>
<td><img src="image3" alt="Image" /></td>
</tr>
<tr>
<td>Metastasis (i.e. Renal Cell Carcinoma)</td>
<td>• Hypervascular pancreatic mass&lt;br&gt;• History of renal cell carcinoma, often 10 to 15 years earlier&lt;br&gt;• Presence suspicious renal mass</td>
<td><img src="image4" alt="Image" /></td>
</tr>
</tbody>
</table>

**Table 3:** Features that differentiate serous cystadenomas from other solid pancreatic masses.

© Radiology, Johns Hopkins Hospital - Baltimore/US
Conclusion

Pancreatic serous cystadenomas can be categorized into microcystic, honeycomb, oligocystic, and solid patterns based on imaging appearances. The presence of typical CT features helps to differentiate serous cystadenomas from other cystic and solid pancreatic masses. Cases with atypical features present a diagnostic challenge as they can mimic malignant neoplasms. Care must be taken in making the specific diagnosis of serous cystadenoma especially if conservative management is selected.
**Personal Information**

L.C. Chu\(^1\), A.D. Singhi\(^2\), R.H. Hruban\(^2\), C.L. Wolfgang\(^3\), B.H. Edil\(^3\), R.D. Schulick\(^3\), J.L. Cameron\(^3\), E.K Fishman\(^1\)

The Russell H. Morgan Department of Radiology and Radiological Science\(^1\), The Department of Pathology\(^2\), and The Department of Surgery\(^3\), Johns Hopkins University, Baltimore, MD, USA.

email: lchu1@jhmi.edu
References


