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Unusual imaging appearances of pancreatic serous cystadenoma: correlation with surgery and pathologic analysis

K. Takeshita,[1] K. Kutomi,[1] K. Takada,[1] H. Kohtake,[1] S. Furui,[1] T. Takada,[2] J. Fukushima[3]

[1]Department of Radiology, Teikyo University School of Medicine, 2-11-1, Itabashi-ku, Tokyo 173-8605, Japan
[2]Department of Surgery, Teikyo University School of Medicine, 2-11-1, Itabashi-ku, Tokyo 173-8605, Japan
[3]Department of Pathology, Teikyo University School of Medicine, Itabashi-Ku, Tokyo 173-8605, Japan

Abstract

Background: We describe imaging and pathologic features of serous cystadenoma of the pancreas on multislice helical computed tomography CT (MS-CT) and surgical resection.

Methods: Radiologic and pathologic features were analyzed in five patients. All patients underwent MS-CT and digital subtraction angiography (DSA), and four patients underwent magnetic resonance (MR) imaging. Preoperatively, three cases showed radiologic evidence of mainly solid appearance on MS-CT, and the suspected diagnoses were solid pancreatic tumors (patients 1–3). The other two cases showed radiologic evidence of macrocystic tumor of the pancreas, and the suspected diagnoses were mucinous cystic tumors (cases 4 and 5). All patients underwent surgery, and the diagnosis of serous cystadenoma was confirmed on pathologic examination.

Results: In three cases that showed a solid appearance on MS-CT, a microcystic appearance was identified on microscopic examination, and the tumors were found to be hypervascular lesions on multiphasic contrast-enhanced CT and DSA. In cases 1 and 2, the lesions showed high intensity with internal septation on T2-weighted MR images. In two cases, the tumors were classified as a macrocystic variant of serous cystadenoma, and no mural nodules, papillary projections, or calcifications were seen in the tumors.

Conclusion: Imaging appearance of serous cystadenoma on MS-CT is various and sometimes indistinguishable from that of solid tumor or mucinous cystic tumors of the pancreas. Imaging findings of hypervascularity and a well-marginated high-intensity lesion with internal septation on T2-weighted MR imaging may be crucial to identify serous cystadenoma that contains no visible cystic compartments on MS-CT.

Key words: Pancreas—Serous cystadenoma—Cystic pancreatic neoplasm—CT—MRI

Correspondence to: K. Takeshita; *email:* takesita@med.teikyo-u.ac.jp

Serous cystadenoma of the pancreas is a benign cystic tumor that also has been known as microcystic adenoma because it is characteristically composed of a large number of tiny cysts. Radiologic diagnosis of serous cystadenoma is usually simple because of its typical microcystic appearance, and current multislice helical computed tomography (MS-CT) with thin collimation has an advantage in demonstrating the microcystic appearance of the tumor with high spatial resolution. When nonsymptomatic, it can be managed without surgery, but surgical resection may be required for unreliable preoperative diagnosis [1]. We encountered five patients who had an unusual appearance of serous cystadenoma in which problematic CT findings led to surgical resection. We describe the imaging and pathologic findings of these patients.

Materials and methods

Radiologic and pathologic features were analyzed in five patients (three male and two female, age range 36–71 years, mean age 46 years) who had pancreatic serous cystadenoma and underwent preoperative MS-CT between November 2002 and January 2004. MS-CT was performed with a multidetector-row eight-channel helical CT unit (Light Speed QX/I, GE Medical Systems, Milwaukee, WI, USA). Nonenhanced images of the upper abdomen were initially obtained by using a collimation

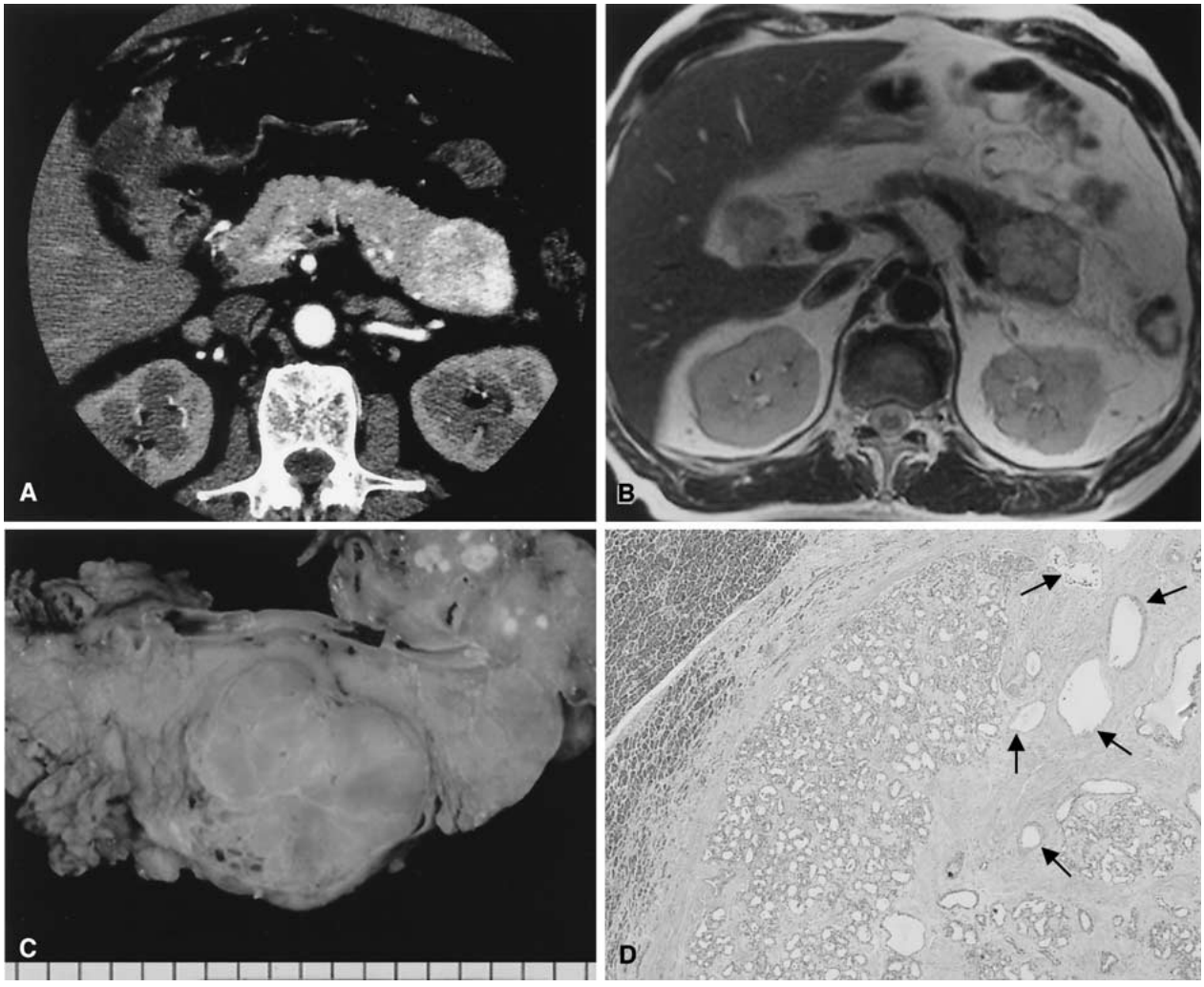

Fig. 1. Case 1: a 65-year-old man. **A** Contrast-enhanced CT scan during arterial phase shows a well-enhanced solid lesion in the pancreatic tail. **B** Axial T2-weighted FSE (5000/112) MR image shows well-defined high-intensity lesion with internal septation and radial pattern of internal stromal elements. **C** Photograph of gross specimen of the lesion demonstrates a well-circumscribed solid lesion. Tiny cysts are barely identified at the peripheral portion of the tumor. **D** Photograph of microscopic view of the lesion displays micrcocystic appearance with abundant stromal tissue and dilated vessels (*arrows*). Cyst walls are composed of simple cuboidal epithelial lining and thick underlying fibrous tissue. Hematoxylin and eosin, original magnification 200×.

of 7 mm. The weight of the patient (kilograms) multiplied by 2 mL of contrast medium at 300 mg I/mL was administered intravenously over 30 s. Three-phase contrast study was performed with 2.5-mm collimation through the pancreas with a breath-hold acquisition. Arterial phase imaging was performed 25 s after initiation of intravenous contrast administration. Pancreatic and portal venous phase images were obtained 50 and 75 s, respectively, after initiation of intravenous contrast administration.

All patients underwent digital subtraction angiography (DSA), and four underwent magnetic resonance (MR) imaging. MR images were obtained with a 1.5-T Signa system (GE Medical Systems). T2-weighted fast spin-echo (FSE) and T1-weighted spin-echo images of the pancreas were obtained in transverse section with respiratory-ordered phase encoding. Slice thickness and interslice gaps were 5 and 1 mm. Heavy T2-weighted FSE images were also obtained in coronal section for MR cholangiopancreatography, and slice thickness and interslice gaps were 3 and 1 mm. Gadolinium-enhanced study on TI-weighted spin-echo images during the equilibrium phase was performed in one patient (case 1).

Lesions were resected by partial pancreatectomy in four patients and pylorus-preserving pancreaticoduodenectomy in one patient. The diagnosis of serous cystadenoma of the pancreas was confirmed on pathologic examination.

Imaging and pathologic findings were evaluated by focusing on the following morphologic features: evidence

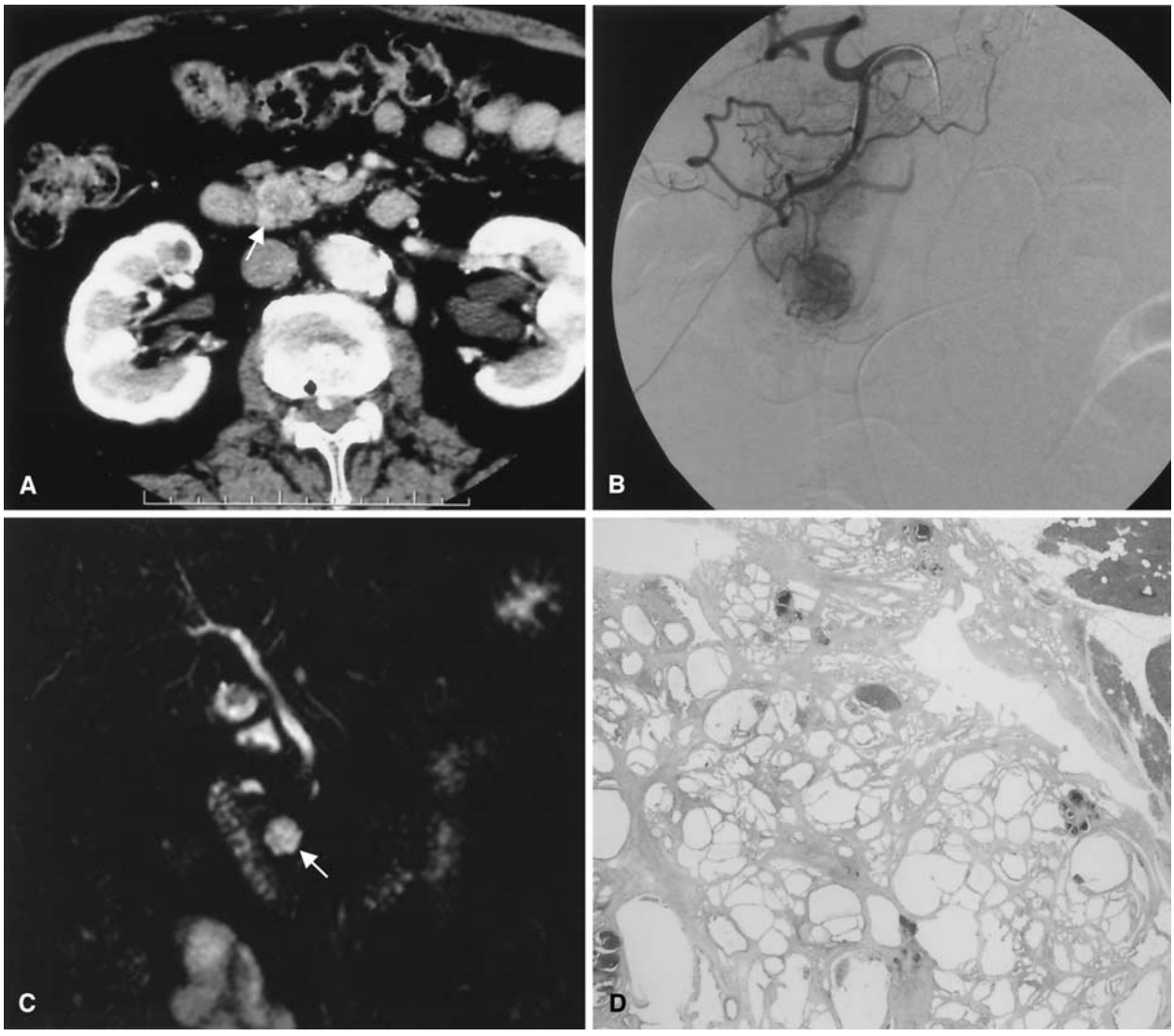

Fig. 2. Case 2: a 69-year-old woman. **A** Contrast-enhanced CT scan during pancreatic phase shows a 10- × 10-mm, ill-defined solid lesion in the pancreatic head (*arrow*). A cystic appearance or internal septation was not identified. **B** Gastroduodenal arteriography shows hypervascular lesion in pancreatic head. **C** Coronal heavy T2-weighted FSE (11,538/197) MR image shows a well-defined, high-intensity lesion with multiple loculations (*arrow*). **D** Photograph of microscopic view of the lesion displays a microcystic appearance in which the cyst is composed of simple epithelial cells lining and underlying fibrous wall. Hematoxylin and eosin, original magnification 20×.

of cystic features, tumor diameter, location of tumor in the pancreas, wall thickness, septations, mural nodules, and calcifications. Vascularity or contrast enhancement of the tumor was also evaluated.

Results

Preoperatively, three cases had radiologic evidence of mainly solid tumor of the pancreas with or without peripheral tiny cystic compartments on MS-CT, and the suspected diagnoses were solid pancreatic tumors (cases 1–3; Figs. 1–3). The other two cases had radiologic evidence of macrocystic tumor of the pancreas, and the suspected diagnoses were mucinous cystic tumors (cases 4 and 5; Figs. 4, 5).

In case 5, the patient presented with dull abdominal pain, serum amylase was high at 319 IU/L, and tumor marker carbohydrate antigen (CA) 19-9 was high at 41.2 IU/L. All other tumor markers, including carcinoembryonic antigen and CA-125, were within normal ranges. Except for case 5, no patients had symptoms related to the pancreatic lesions, and serum tumor markers (CA-19-9, carcinoembryonic antigen, and CA-125) and serum amylase were within normal ranges.

In three cases with solid appearance on MS-CT, histologic examination showed innumerable tiny cysts within the tumors that appeared grossly as solid masses

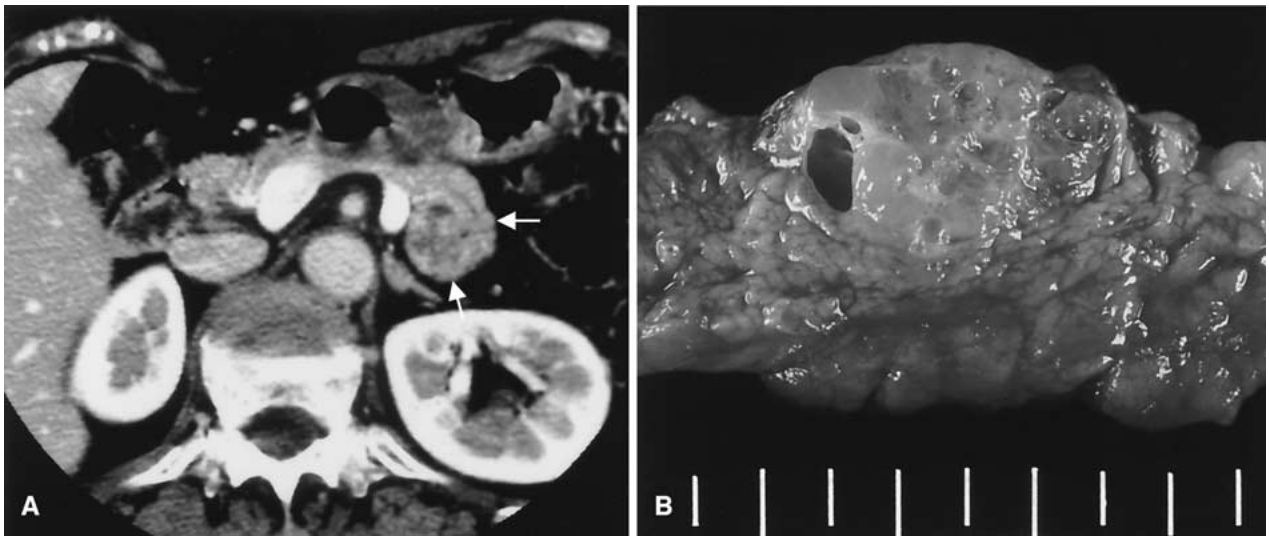

Fig. 3. Case 3: a 70-year-old woman. **A** Contrast-enhanced CT scan during pancreatic phase shows a heterogeneously enhancing lesion with peripheral, small cystic parts (*arrows*) in the pancreatic body to tail. **B** Photograph of gross specimen of the lesion demonstrates a well-circumscribed solid lesion within several small cystic parts.

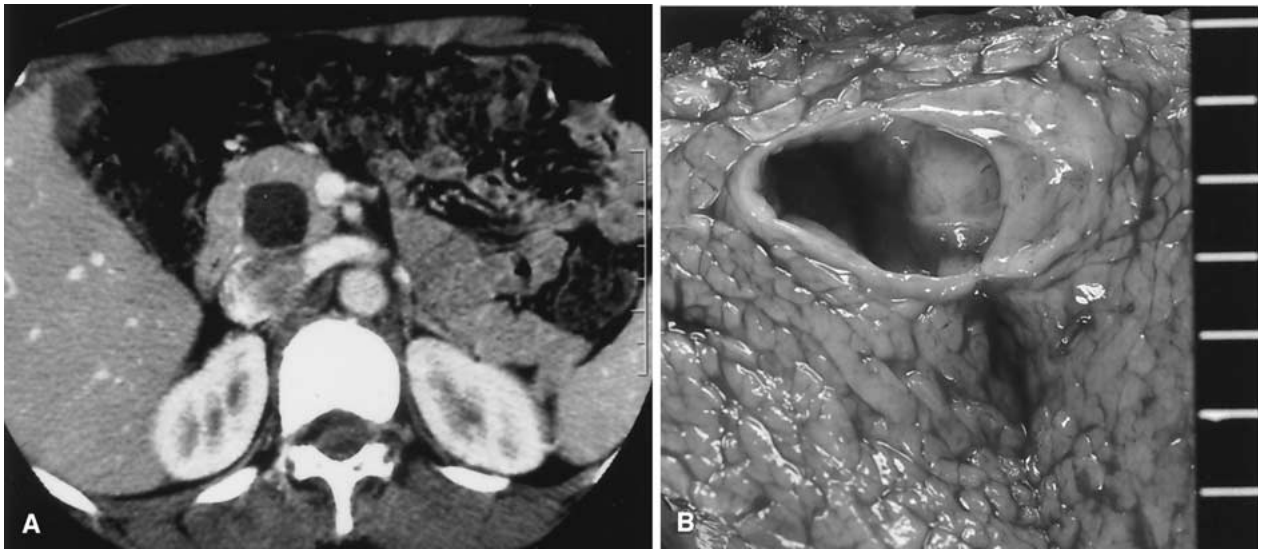

Fig. 4. Case 4: a 38-year-old woman. **A** Contrast-enhanced CT scan during pancreatic phase shows a well-defined unilocular cystic lesion in the pancreatic head. **B** Photograph of the gross lesion specimen demonstrates a well-circumscribed, smooth-walled unilocular cystic lesion.

(Figs. 1–3). In case 1, the tumor was located in the pancreatic tail and the lesion was 40 mm (Fig. 1A,B). The lesion appeared as mainly solid, and tiny cysts were barely identified at the peripheral portion of the tumor on gross histologic examination (Fig. 1E). The microcystic appearance with abundant stromal tissue and dilated vessels were identified on microscopic examination (Fig. 1D). In cases 2 and 3, tumors were located in the pancreatic head and body, and the lesions measured 10 and 30 mm, respectively (Figs. 2, 3). Microcystic appearance was identified on gross and microscopic histologic examinations (Figs. 2D, 3B).

In cases 1 and 2, the lesions appeared as well-marginated, high signal intensity lesions with internal septation on T2-weighted MR images, which corresponded to the microcystic structures (Figs. 1B, 2C). In case 1, the lesion appeared as a well-enhancing solid lesion on gadolinium-enhanced study. In these three cases, the tumors were found to be hypervascular lesions on DSA (Fig. 2B) or multiphasic contrast-enhanced CT.

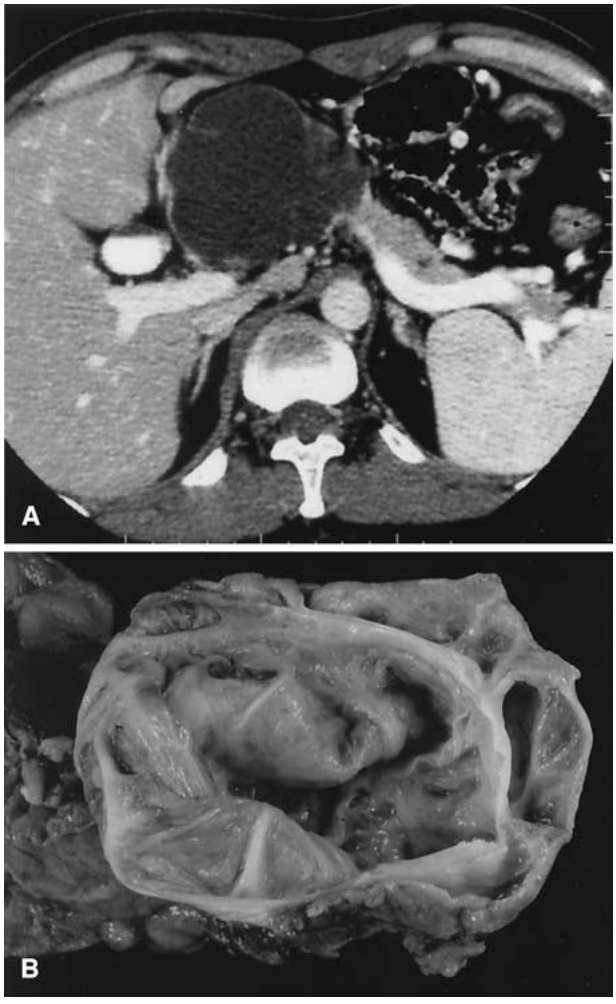

Fig. 5. Case 5: a 37-year-old man. **A** Contrast-enhanced CT scan during pancreatic phase shows a well-defined, multilocular cystic lesion in the pancreatic head. **B** Photograph of gross specimen of the lesion demonstrates a well-circumscribed, smooth-walled multilocular cystic lesion with internal septations.

In two cases with macrocystic appearance on MS-CT, the tumors were classified as a macrocystic variant of serous cystadenoma. In case 4, the tumor was monocystic and located in the pancreatic head, and the lesion measured 22 mm (Fig. 4). In case 5, the tumor was multiloculated and located in the pancreatic head, and the lesion measured 60 mm (Fig. 5). In both cases, cystic fluid showed low signal intensity on T1-weighted MR images and high signal intensity on T2-weighted MR images. The walls were smooth in both cases and thinner than 2 mm. In two cases of the macrocystic type, the tumors were found to be hypovascular lesions on DSA.

No mural nodules, papillary projections, or calcifications were seen in any of the tumors.

Discussion

Serous cystadenoma of the pancreas is composed of innumerable microcysts lined by epithelial cells that have clear to pale eosinophilic cytoplasm and central nuclei that do not have pleomorphism. Serous cystic tumor of the pancreas is a benign tumor except for some reported cases [2, 3], and most patients who have serous cystadenoma do not require resection. However, a high degree of diagnostic reliability is crucial. In our five cases of serous cystadenoma, surgical resections were performed based on the preoperative diagnosis of solid pancreatic tumors or mucinous cystic tumors that have malignant potential.

Solid areas of serous cystadenoma on imaging findings or gross histologic examination may be more common than previously reported, but the solid variant of serous cystadenoma on microscopic histologic examination is extremely rare, and only one case has been reported in the recent literature. Perez-Ordonez et al. reported a pancreatic tumor with solid architecture but cytologic, histochemical, and immunohistochemical features similar to those of serous cystadenoma [4]. Recognition of the solid variant of serous cystadenoma on imaging findings or gross histologic examination is important because the vast majority of solid tumors in the pancreas are malignant, and the differential diagnosis of solid tumor with hypervascularity includes islet cell tumors and metastatic renal cell carcinomas.

MS-CT with thin collimation would be sensitive in depicting microcystic architecture or internal septations of the serous cystadenoma. In cases 1 and 2 that were examined with MR imaging, cystic appearances were identified as a high-intensity lesion with internal septation on T2-weighted images, but MS-CT failed to demonstrate the microcystic appearance, probably due to relatively insufficient contrast and spatial resolution. This suggests that MR imaging has an advantage in depicting the microcystic appearance with high contrast resolution that distinguishes cystic fluid space from internal septation and/or surrounding pancreatic parenchyma. Taniuchi et al. reported a similar case of serous cystadenoma and reported that MR imaging is a mandatory modality to identify pancreatic serous cystadenoma that contains no visible cystic compartments on CT and ultrasonography [5].

Macrocystic serous cystadenoma is a particular variant of pancreatic serous cystadenoma, and several cases have been described in the literature [6–14]. Egawa et al. described unilocular or oligocystic lesions of the pancreas in which the individual cysts were lined by clear or pale cuboidal epithelium that contained large amounts of glycogen, and they proposed the term macrocystic serous cystadenoma [10]. Many researchers have reported that the imaging appearances of macrocystic serous cystadenoma are difficult to distinguish from those of mucinous

cystic neoplasm or pseudocyst because of the similarity in cystic appearance and the nonspecific signal intensity pattern of cystic fluid on MR imaging. Mucinous cystic tumors affect women almost exclusively and involve predominantly the tail of the pancreas. These tumors are composed of mucin-producing epithelial cells with "ovarian type" stroma and have malignant potential [13]. All mucinous cystic neoplasms of the pancreas should be resected because of their potential for malignant degeneration [12].

Cohen-Scali et al. reported that certain findings (lobulated contour, absence of wall enhancement, and location in the pancreatic head) are observed more often in unilocular macrocystic serous cystadenoma than in mucinous cystadenoma and pseudocyst [14]. In our cases of unilocular macrocystic serous cystadenoma (case 4), the lesion also demonstrated an absence of wall enhancement and was located in the pancreatic head. These findings may be helpful in the diagnosis of unilocular macrocystic serous cystadenoma. Khadaroo et al. reported two cases of macrocystic serous cystadenoma that were successfully diagnosed with cytodiagnosis by transabdominal fine-needle aspiration [9]. Analysis of cystic fluid has been reported as potentially useful to identify malignancy or potential malignancy among various pancreatic cystic lesions. Chatelain et al. reported that measuring enzymes and tumor markers may contribute to the diagnosis of macrocystic serous cystadenoma by showing low concentrations [7]. In our two cases of macrocystic serous cystadenoma, neither cytodiagnosis nor fluid analysis was performed preoperatively.

In conclusion, the imaging appearance of serous cystadenoma is various, and problematic CT findings may lead to an error in diagnosis by the prospective interpreter. Unusual imaging appearance of serous cystadenoma is sometimes indistinguishable from that of solid tumors or mucinous cystic tumors of the pancreas, which require surgical resection. Imaging findings of hypervascularity and well-marginated high-intensity area with internal septation on T2-weighted MR images may be crucial to identify pancreatic serous cystadenoma that contains no visible cystic compartments on MS-CT, and these findings may be useful to avoid extended surgery.

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