

Pancreatic Candidiasis That Mimics a Malignant Pancreatic Cystic Tumor on Magnetic Resonance Imaging: A Case Report in an Immunocompetent Patient

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Candida is a commensal organism that is frequently found in the human gastrointestinal tract. It is the most common organism that causes pancreatic fungal infections. However, magnetic resonance imaging findings of *Candida* infection in the pancreas have not been described. We report imaging findings of pancreatic candidiasis in a patient in immunocompetent condition. It presented as a multi-septated cystic mass with a peripheral solid component in the background of pancreatitis and restricted diffusion on diffusion-weighted image that mimicked a malignant pancreatic cystic tumor.

Index terms: Pancreas; *Candida*; Infection; Magnetic resonance imaging

INTRODUCTION

Infection is one of the leading causes of morbidity and mortality in patients with severe acute pancreatitis (1). Although a healthy pancreatic gland is relatively resistant to invasion by fungal organisms, an inflamed gland has a higher rate of infection, which is directly proportional to the extent of necrosis. Thus, pancreatic fungal infection is associated with severe acute pancreatitis, in addition to continuous use of prophylactic fluconazole and surgical or endoscopic pancreatic intervention (2). The increase in the population of patients with altered immunity because of organ transplantation (3) or other causes of an acquired immunocompromised condition (4) has resulted in a steady

increase in the incidence of opportunistic infections of the pancreas.

Among various sources of pancreatic fungal infections, *Candida* is the most common causal organism, followed by *Torulopsis* species (5). The incidence of *Candida* infection in acute pancreatitis has been reported to range from 12% to 41%. Diagnosis of pancreatic infection is made when infective organisms are identified from aspirate or blood culture. However, routine blood cultures are positive in only 50% of patients with tissue-proven disseminated candidiasis (6). Thus, imaging could potentially help to differentiate fungal infection of the pancreas from other causes in patients with negative or ambiguous laboratory results. However, to the best of our knowledge, the magnetic resonance (MR) imaging findings of pancreatic candidiasis have not yet been described. We report here the MR imaging findings of a patient with pancreatic candidiasis and provide a review of the relevant medical literature.

CASE REPORT

Institutional Review Board approval was obtained, and the requirement for informed consent was waived for this retrospective case report. This report followed the proposed

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CARE guidelines (7).

A 56-year old male visited the emergency department because of epigastric pain for the past week; he also

complained of radiating pain to his back. The patient had a history of endoscopic ampullectomy for an ampulla of Vater adenoma four years prior and subsequent transduodenal

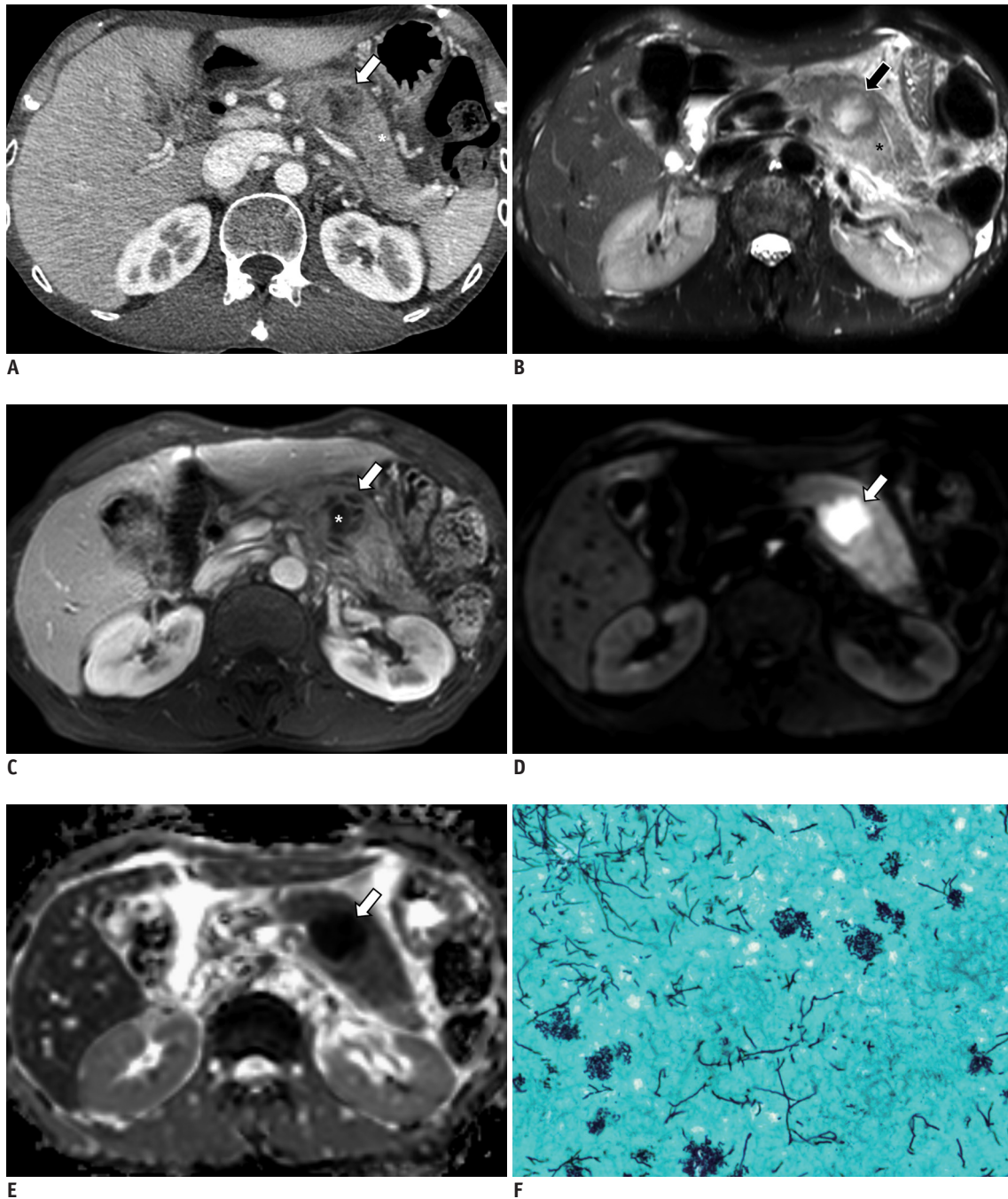


Fig. 1. Pancreatic candidiasis in 56-year-old man.

A. On axial CT scan obtained at portal phase, 3.4 cm multi-septated cystic lesion with lobulating contour (white arrow) is observed between body and tail of pancreas. Pancreas tissue around lesion is mildly swollen (asterisk). **B.** On T2-weighted axial MR image, cystic mass (black arrow) has relatively low signal intensity component compared with adjacent swollen pancreas (asterisk) at periphery and internal thick septa. **C.** In dynamic enhancement study, thick peripheral portion and internal septa of tumor (white arrow) are enhanced. Non-enhanced portion (asterisk) matches region of hyperintensity on T2-weighted image, indicating necrotic portion or cystic component of mass. **D.** On diffusion-weighted image with b-value of 800, lesion (white arrow) shows high signal intensity. **E.** Apparent diffusion coefficient value of corresponding area is low, indicating presence of diffusion restriction (white arrow). **F.** Gomori's methenamine-silver staining highlights multiple fungal hyphae, consistent with *Candida* species (x 200).

ampullectomy because of a recurrence of tubular adenoma with high-grade dysplasia. On physical examination, tenderness at the epigastrium and upper left quadrant of the abdomen was present. Except for mild elevation in inflammatory markers (C-reactive protein, 8.97 mg/dL; erythrocyte sedimentation rate, 43 mm/hr), the other lab results at presentation were unremarkable, including serum amylase and lipase levels (47.5/25.6 U/L).

After the patient's admission, computed tomography (CT) was performed to assess abdominal pain using a 64-slice multidetector CT scanner (LightSpeed VCT; GE Healthcare; Milwaukee, WI, USA). Contrast-material-enhanced axial CT images showed a 3.4-cm multi-septated low-density lesion with a lobulating contour between the body and tail of the pancreas. Pancreas tissue around the lesion was mildly swollen, and peripancreatic fat infiltration was noted. However, the main pancreatic duct was not dilated. There was no regional lymph node enlargement around the pancreas (Fig. 1A). Based on these CT findings, we considered a pseudocyst associated with pancreatitis, an unusual form of focal pancreatitis including an abscess, and pancreatic cystic tumor as part of the suite of differential diagnosis.

To further characterize the lesion, an MR study was performed using a 3T whole-body MR system (InteraAchieva 3T, Philips Healthcare, Best, the Netherlands) with a 16-channel phased-array receiver coil. For the enhancement studies, gadoteric acid as a contrast agent (Gd-E0B-DTPA, Primovist or Eovist, Bayer Healthcare, Berlin, Germany) was administered intravenously. On a T2-weighted image, there was a relatively well-defined pancreatic cystic mass with irregular internal thick septa in the body portion of the pancreas that had a peripheral low signal intensity component compared with the adjacent swollen pancreas (Fig. 1B). During dynamic enhancement, the thick peripheral portion of the tumor and internal septa were enhanced. An internal non-enhancing portion within the mass that matched the high signal intensity on the T2-weighted image was detected, indicating a necrotic portion or cystic component (Fig. 1C). On the diffusion-weighted image with a b-value of 800, the lesion showed high signal intensity (Fig. 1D), and the corresponding area had a low value on the apparent diffusion coefficient map, indicating the presence of restricted diffusion compared with the surrounding inflamed pancreas parenchyma (Fig. 1E).

Based on these imaging findings, unusual pancreatitis with pancreatic abscess formation, solid pseudo-papillary

neoplasm, neuroendocrine tumor with cystic degeneration and malignant pancreas cystic tumor including mucinous cystic neoplasm and intraductal papillary mucinous neoplasm with an associated invasive carcinoma were considered in the differential diagnosis. Under suspicion of a malignant cystic tumor of pancreas based on the imaging findings, distal pancreatectomy with splenectomy was performed. At operation, this cystic lesion was palpated as a solid mass. In addition, severe pancreatitis with adhesion to the adjacent stomach and the liver was seen. An abscess was confirmed by frozen biopsy.

On histopathologic analysis, multifocal abscesses were seen in the pancreas parenchyma and peripancreatic tissue. Dilatation of branch ducts with intraluminal fungal organisms was noted, consistent with *Candida* infection. In addition, Gomori's methenamine-silver and periodic acid Schiff stains revealed fungal organisms that showed hyphae (Fig. 1F).

DISCUSSION

Risk factors for pancreatic fungal infection include prophylactic broad-spectrum antibiotics in patients with severe acute pancreatitis and abdominal surgical manipulation after an episode of acute pancreatitis. Endoscopic retrograde cholangiopancreatography, use of total parenteral nutrition, and mechanical ventilation are additional risk factors (2). Other conditions that result in an altered host immune system such as steroid therapy, chemotherapy, acquired immunodeficiency syndrome (AIDS), immunosuppression therapy after organ transplantation, advanced age, and comorbid illnesses such as diabetes mellitus also predispose patients to fungal infection (5). In our case, a history of repeated ampullectomy may have contributed to opportunistic infection of the pancreas by *Candida* despite the patient's immunocompetent condition.

The increase in prevalence of solid organ transplantation has increased the number of patients who receive immunosuppressive therapy. The Transplant-Associated Infection Surveillance Network reported a one-year cumulative incidence of pancreatic fungal infection of 3.4%; the most common invasive fungal infection was invasive candidiasis (53%) (8). In addition, AIDS patients are more susceptible to opportunistic infections including fungal infections but often do not present with symptoms. Thus, the role of imaging studies is becoming increasingly important (4). Although three recognizable forms of

pancreatic infection—infected pancreatic necrosis, infected pseudocyst, and pancreatic abscesses—are known (5), the radiologic features of pancreatic candidiasis have been described in only one case report based on CT scans (9).

In our study, a cystic mass with an enhanced peripheral portion and necrotic inner portion that showed restricted diffusion on a background of pancreatitis was observed in MR images. Although there were no laboratory findings of pancreatitis, these findings could suggest the possibility of pancreatic abscess first. In addition, malignant pancreatic cystic tumors such as solid pseudo-papillary neoplasms, neuroendocrine tumors with cystic degeneration, and malignant pancreas cystic tumors (i.e., mucinous cystic neoplasms or intraductal papillary mucinous neoplasms with an associated invasive carcinoma) could be considered as differential diagnoses based on imaging findings because of the presence of diffusion-restriction of the lesion and a relatively thick enhanced peripheral portion with irregular septa (10). However, poor enhancement of a peripheral solid portion and male predominance are not common in cases of neuroendocrine tumor with cystic degeneration, solid pseudo-papillary neoplasm, or mucinous cystic neoplasm (10).

Other differentiating features may be the presence of accompanying pancreatitis in the setting of a patient with predisposing factors for pancreatic fungal infections compared with pancreatic cystic tumors. Overlap of diffusion restriction between a fungal abscess and malignant cystic tumor can be explained as follows. The high viscosity of inflamed materials may restrict the freedom of motion of water molecules within the abscess cavity similar to the compact tumor cellularity of a malignant pancreatic tumor (11). Considering the limitation of diffusion-weighted imaging for the diagnosis of pancreatic candidiasis, diagnosis should be based on a combination of conventional MR imaging and clinical setting.

We suggest that a relatively well-defined cystic mass with internal septation and diffusion restriction in the background of pancreatitis could be MR imaging findings of pancreatic candidiasis manifesting as a pancreatic abscess. If a proper diagnosis is possible prior to surgical resection of the pancreas, the extent of surgery may differ from that of surgical resection to save more unaffected pancreatic

tissue because most pancreatic fungal infections can be managed by less invasive therapies such as necrosectomy, necrostomy, and/or percutaneous catheter drainage rather than anatomical pancreatic resection (2, 5).

In conclusion, pancreatic candidiasis can manifest as a solitary abscess that should be differentiated from malignant cystic tumor of the pancreas. Therefore, pancreatic candidiasis could be considered in the differential diagnosis of a pancreatic cystic mass, especially in patients with factors that predispose them to pancreatic fungal infections.

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