







Inflammatory Myofibroblastic Tumor of the Pancreas: A Case Report and Literature Review

췌장에서 발생한 염증성 근섬유모세포종:
증례 보고와 문헌 고찰

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Inflammatory myofibroblastic tumors (IMTs) are rare. They are characterized by myofibroblastic spindle cell proliferation with a varying degree of inflammatory cell infiltration. IMT can occur in any anatomic location but has been reported in the lung, mesentery, and omentum, mainly in children or young adults. It rarely occurs in the pancreas and is often difficult to distinguish from other tumors, including some malignant ones. Therefore, it can be challenging to make a radiological diagnosis of IMT. Here, we present a case of IMT that occurred in the pancreas head of a middle-aged female. The patient's ultrasonography, computed tomography, and magnetic resonance imaging findings are presented along with a review of the literature.

Index terms Pancreas; Pancreatic Neoplasm; Granuloma, Plasma Cell

INTRODUCTION

Inflammatory myofibroblastic tumor (IMT) is a relatively rare mass-forming lesion and occurs primarily in visceral and soft tissue of children and young adults. IMT was originally reported in the lung by Brunn (1) and was traditionally considered inflammatory pseudotumor (IPT) until the World Health Organization (WHO) officially named it IMT in 2002 (2). The etiology and the pathogenesis of IMT are unknown, although several viral infection (Epstein-Barr virus, human herpesvirus-8, etc) have been observed in a number of cases as etiological factors (3). IMTs can occur throughout the body, the most common sites of involvement were the lung, mesentery, and omentum (4). IMT of pancreatic origin is very rare, and about 28 of histologically confirmed cases have been reported in the English literature (5, 6). Here we present a case of a middle-aged woman with a symptom of jaundice caused by an IMT of the pancreatic head portion.

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CASE REPORT

A 48-year-old woman was referred to our hospital with a pancreatic mass, detected on an abdominal ultrasonography (US). She had suffered mild pruritus and jaundice over the past some days, and no other unusual medical history before. Initial laboratory investigation showed liver enzyme (total bilirubin 3.8 mg/dL, aspartate aminotransferase 178 U/L, alanine aminotransferase 77 U/L, alkaline phosphatase 1295 U/L), CA 19-9 (235 U/mL) and C-reactive protein (7.89 mg/dL) were elevated. US exam showed a well-margined, lobulated, and slightly hypoechoic solid mass in the pancreatic head (Fig. 1A). It caused only diffuse biliary tree dilatation, without pancreatic duct dilatation or upstream pancreatic atrophy. The computed tomography (CT) and the magnetic resonance (MR) imaging scans revealed a well-defined 5.3 cm × 4.7 cm × 7.9 cm sized large solid mass in the pancreas head portion. On the contrast-enhanced CT scan, the mass showed lower attenuation than the normal pancreatic parenchyma in the pre-contrast phase, and heterogeneous hyperenhancement in the arterial and portal venous phase (PVP). The mass showed relatively homogeneous enhancement in the delayed phase (Fig. 1B). Neither calcification in the mass nor enlarged lymph node was found in the abdominopelvic cavity. On the MR imaging scan using a 3-Tesla imaging system (Discovery MR750, GE Healthcare, Waukesha, WI, USA) the mass showed hyperintensity in T2-weighted image and hypointensity in pre-contrast T1-weighted image than the normal pancreatic parenchyma. On the dynamic contrast-enhanced scan using gadoxetic acid, the mass showed heterogeneous enhancement in early and late arterial phase, and relatively homogeneous enhancement in PVP and 3-minute transitional phase, with represented highest tumoral enhancement in PVP (Fig. 1C). On the next day of hospitalization, the PET-CT showed a significant fluorine-18 fluorodeoxyglucose (¹⁸F-FDG) uptake in the mass (Fig. 1D). Our initial differential diagnosis included pancreatic epithelial tumor (such as neuroendocrine tumor or solid pseudopapillary neoplasm), pancreatic mesenchymal tumor (such as sarcoma or solitary fibrous tumor), or retroperitoneal origin solid tumor (such as schwannoma). After surgical laparotomy, a well-encapsulated mass originated from the pancreatic head portion without presence of lymphadenopathy or any vascular invasion was found.

The final histopathological diagnosis was IMT of the pancreas. Grossly, the tumor was a relatively well-circumscribed nodular mass with yellow to tan fleshy cutsurface, measuring 8.9 cm × 5.7 cm in size (Fig. 1E). The tumor was composed of bland spindle cells admixed with lymphocytes and plasma cells. The tumor showed low mitotic rate (1-2/50 high power fields), mild nuclear atypia, and no necrotic area. Immunohistochemistry showed only focal cytoplasmic or membrane positivity for smooth muscle actin. Tumor cells were negative for anaplastic lymphoma kinase-1 (ALK-1), cytokeratin, and CD117.

DISCUSSION

Almost all pancreatic neoplasms occur in the epithelial components (95%) and non-epithelial neoplasms of pancreas comprise only 1-2% of all neoplasms of pancreas (5). Mesenchymal tumors are the most common non-epithelial neoplasms identified in the pancreas, consist of sarcoma, solitary fibrous tumor and IMT (5). The term IMT, commonly considered

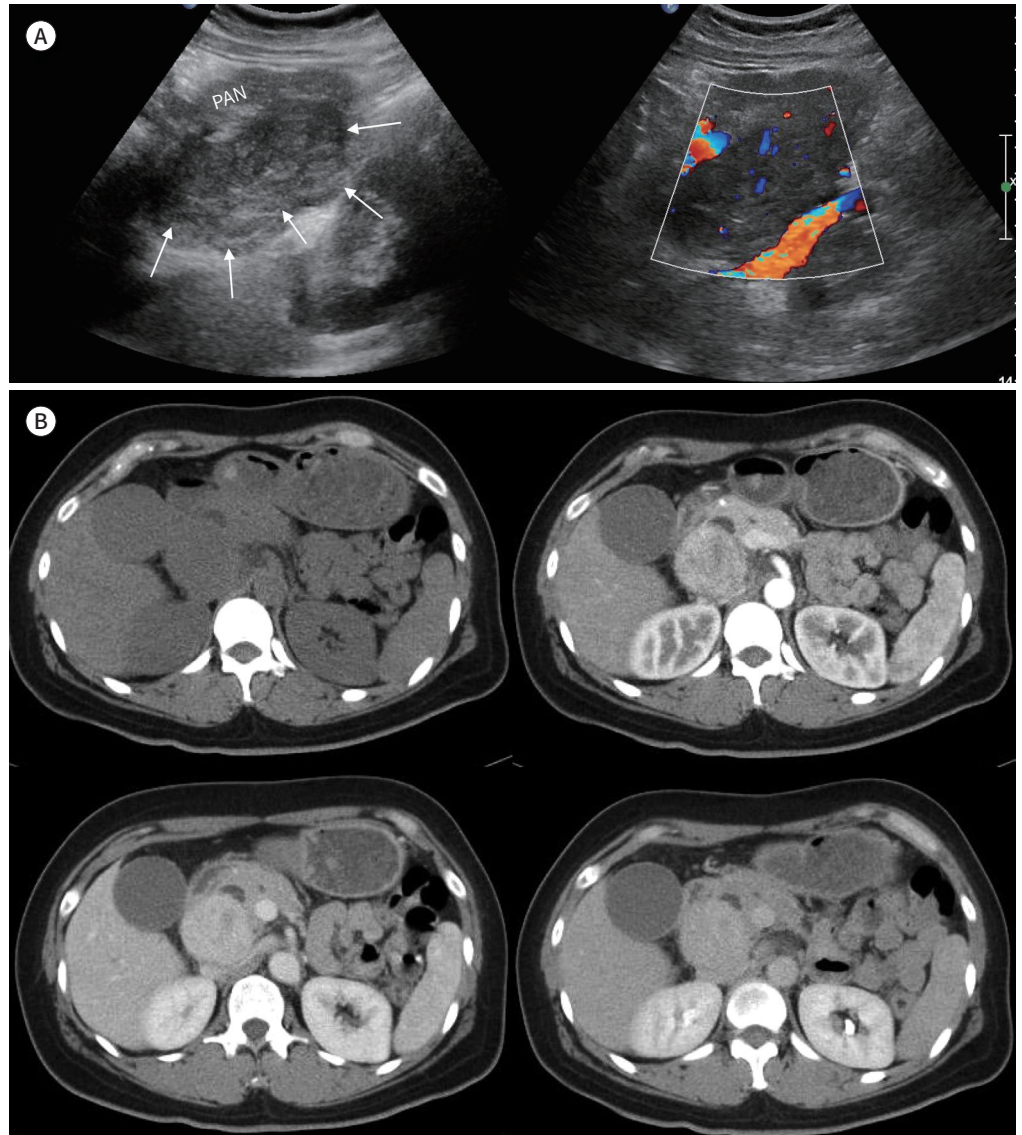
synonymous with IPT in previous literature, was first described in a study of about 20 pulmonary inflammatory lesions in 1990 by Pettinato et al. (7). Currently, it has been revealed that IMT may have gene rearrangement involving ALK, and IgG4-positive plasma cells can play an important role in the pathogenesis of some IPTs (8). Although there still remains controversy, these histopathologic and cytogenetic advances suggest that IMT and IPT are two dis-

Fig. 1. A 48-year-old woman with inflammatory myofibroblastic tumor in the pancreas.

A. Abdominal ultrasound (left) grayscale and (right) color Doppler images showing a well-circumscribed hypoechoic mass lesion (arrows) in the head portion of the PAN, with focal intratumoral vascularity.

B. Axial dynamic CT (left upper) pre-contrast, (right upper) arterial, (left lower) portal venous, and (right lower) delayed phase images reveal a 5.3 cm × 4.7 cm sized well-defined solid mass in the head portion of the pancreas. In the pre-contrast phase, the mass shows lower homogeneous attenuation than the normal pancreatic parenchyma. In the contrast-enhanced images, the mass shows heterogeneous hyperenhancement in the arterial, portal venous phase, and relatively homogeneous enhancement in the delayed phase. There is no demonstrable calcification or cystic portion within the mass.

PAN = pancreas



tinct separated entities rather than parts of a clinicopathological continuum. Although IMT usually following a benign course, some of IMT cases have been reported local infiltration and recurrence as well as distant metastasis that cannot be explained by the inflammatory response (4). For this reason, IMT can be confused with malignancy clinically and radiologically, and the majority of literature in recent years has been further inclined to classify it as a potential intermediate malignant neoplasm.

According to a recent literature by Matsubayashi et al. (6), a total of 28 cases of histologically proven pancreatic IMTs using English literature survey has been reviewed. They summarized the characteristics of the 28 cases of pancreatic IMTs as follows; middle-aged onset (mean age: 40 years old), slightly male predominance (17 males and 11 females), mostly oc-

Fig. 1. A 48-year-old woman with inflammatory myofibroblastic tumor in the pancreas.

C. Axial magnetic resonance imaging scan T2-weighted image (1st), pre-contrast T1-weighted image (2nd), arterial phase (3rd), portal venous phase (4th), 3-minute transitional phase (5th), hepatobiliary phase images (6th). The mass shows hyperintensity on the T2-weighted image and hypointensity on the pre-contrast T1-weighted image. In a dynamic study after gadolinium-EOB-DTPA enhancement, the mass shows heterogeneous arterial enhancement and progressive homogeneous enhancement towards the transitional phase.

D. ^{18}F -FDG PET (left) and ^{18}F -FDG PET/CT (right) images show the pancreatic mass with a high FDG uptake (maximum standardized uptake value: 17.0).

^{18}F -FDG = fluorine-18 fluorodeoxyglucose

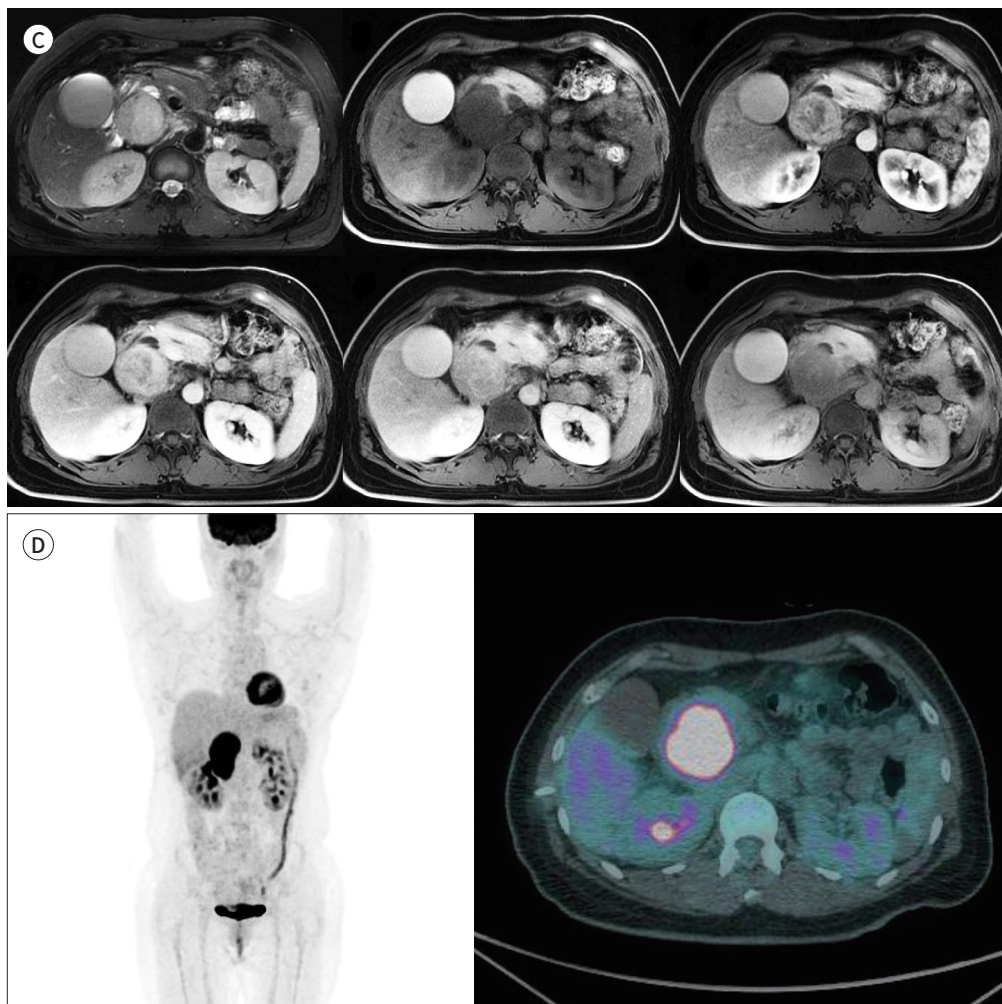
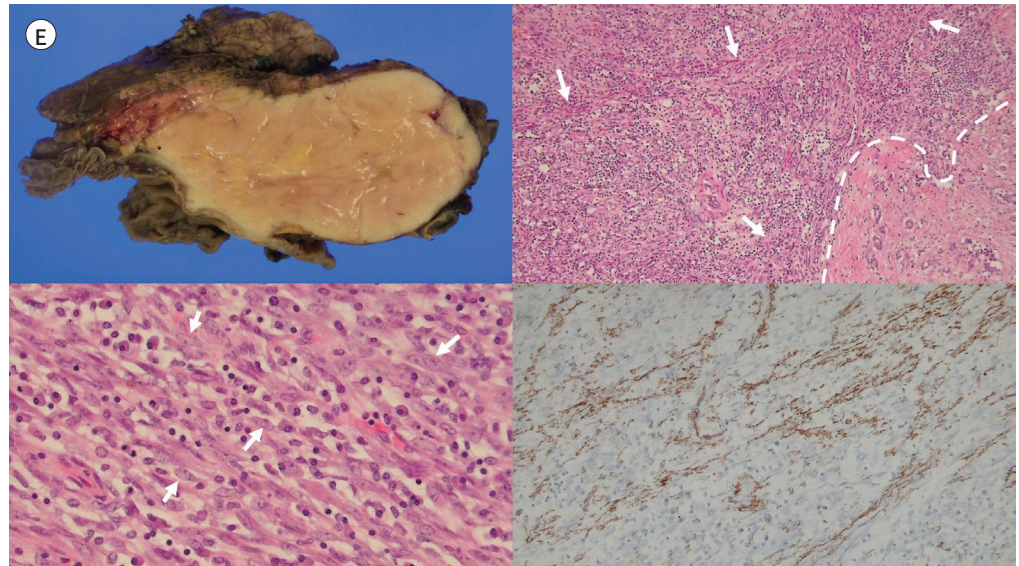


Fig. 1. A 48-year-old woman with inflammatory myofibroblastic tumor in the pancreas.

E. Surgical specimen obtained after pylorus-preserving pancreaticoduodenectomy (left upper). A fascicular pattern of spindle cells and inflammatory infiltrate can be seen (tumor: left side of the dotted line, pancreas: right side, fascicular arrangement: arrows) (H&E stain, $\times 100$) (right upper). The tumor cells show mild nuclear atypia and no mitosis or necrosis (arrows, H&E stain, $\times 400$) (left lower). Immunohistochemistry shows focal positivity for smooth muscle actin ($\times 200$) (right lower).

H&E = hematoxylin and eosin



curred in pancreatic head (20 in the head, 2 in the body, 4 in the tail, 2 in the body and tail), a mean size of 4.7 cm, various outcome (22 cases were not recurrence, one case was stable disease, one case was recurrence, and one case was died of sepsis). Interestingly, large number of cases were accompanied by clinical symptoms such as abdominal pain or discomfort (56%) or jaundice (44%). According to the literature of Coffin et al. (9) which studied 59 cases of IMTs without pancreatic IMT, they showed that younger onset (mean age: 13.2 years old), nearly equal gender ratio (29 male and 30 female), larger tumor size (mean size: 7.8 cm), poorer outcomes (recurrence: 56%, metastasis: 10%, no recurrence: 42%). Therefore, pancreatic IMTs are thought to be more likely to have a relatively benign nature than other systemic IMTs, with more apparently onset in middle-age. Our case was almost consistent with the aforementioned usual characteristics of the pancreatic IMT.

The radiologic features of IMT are not well known but various with depending on the degree of fibrosis and cellular infiltration, and it is generally described as a lobulated heterogeneous solid mass with or without cystic component and/or calcification (5). On the US, IMT can be hypoechoic or hyperechoic, with often indicating increased vascularity on Doppler images. On the CT and MR imaging, IMT can show variable attenuation and signal intensity with variable heterogeneous enhancement. Sometimes, IMTs are often challenging for radiologists to make diagnoses, most commonly mistaken for pancreatic cancer, especially when they cause biliary and/or pancreatic ductal obstruction. Extensive pathologic and cytologic examination is essential in this case, because of not only the rarity of the disease but also difficulty of differential diagnosis with the pancreatic cancer radiologically, even though CA 19-9 level maybe helpful. FDG uptake of IMT in PET-CT was reported to show high variability

of maximum standardized uptake value (range from 3.3 to 20.8) depending on the composition and inflammatory activity of tumor cells (10). Therefore FDG PET-CT may not be able to differentiate IMT from malignancy because both can show increased FDG uptake (10). However, FDG PET-CT is useful for the detection of primary tumors, local recurrence, distant metastasis, and the evaluation of treatment response (10). In our case, the mass could be differentiated from the pancreatic cancer because the pancreatic duct was not dilated and the mass showed well-defined relatively hyperenhancement in the contrast-enhanced study. However, when pancreatic head mass (or retroperitoneal mass) reached a certain size, it is very difficult to identify its origin by imaging. Our case also caused some difficulties in radiological diagnostic approach. Therefore, the tumor of retroperitoneal origin was included as an initial differential diagnosis to approach diagnosis.

Our case showed the maximum diameter of the mass was relatively large, about 8 cm, but there was no necrosis or degeneration. Although the mass caused biliary obstruction, distant metastasis or invasion to other organs was not found. So the possibility of sarcoma was considered low. Considering that it occurred in middle-aged women and was a nearly solid tumor located in the pancreatic head, the possibility of solid pseudopapillary neoplasm was also considered to be low. On the contrast-enhanced CT/MR images, the mass showed well-circumscribed margination with heterogeneous well-enhancement in arterial phases and progressive homogeneous enhancement in delayed phase, these suggested high probability of solitary fibrous tumor. However, the possibility of a neuroendocrine tumor or retroperitoneal schwannoma without degeneration has still remained, and it was difficult in making a differential diagnosis radiologically. Moreover, because the tumor showed uptake in PET-CT, malignancy could not be completely excluded, it was hard to make a diagnosis clinically without histopathological study.

In conclusion, while imaging findings of IMT of the pancreas are somewhat not specific, but when well-defined, heterogeneously enhancing solid pancreas mass occur in the middle-age, which shows less necrosis or degeneration despite the large size, and cause biliary obstruction or other symptoms, the IMT should be included in the differential diagnoses.

Author Contributions

Conceptualization, all authors; data curation, all authors; investigation, L.K.; project administration, K.H.; resources, K.H.; supervision, K.H.; validation, K.H.; visualization, L.K.; writing—original draft, L.K.; and writing—review & editing, K.H.

Conflicts of Interest

The authors have no potential conflicts of interest to disclose.

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췌장에서 발생한 염증성 근섬유모세포종: 증례 보고와 문헌 고찰

임경재¹ · 조진한¹ · 박민경² · 권희진^{1*}

염증성 근섬유모세포종(inflammatory myofibroblastic tumor)은 드문 종양으로, 조직학적으로 근섬유모세포성 방추세포의 증식과 다양한 염증 세포들의 침윤을 특징으로 한다. 이 종양은 전신의 모든 해부학적 위치에서 생길 수 있으나 주로 폐, 장간막, 대망에서 생긴다고 보고되어 있으며, 대부분의 경우 어린이 또는 젊은 성인에서 발생한다. 췌장에서 발생하는 경우는 매우 드물며, 악성 종양을 포함한 다른 종양과 구별하기 어렵기 때문에 정확한 영상 의학적 진단이 어려운 경우가 흔하다. 이에 저자는 중년 여성의 췌장 두부에서 발생한 염증성 근섬유모세포종의 사례를 초음파, 컴퓨터단층촬영, 자기공명영상 소견들과 함께 제시하고 문헌을 검토하고자 한다.

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