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Autoimmune pancreatitis: Characteristics on CT imaging

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Background : *Autoimmune pancreatitis (AIP) is a rare disease, describes a form of chronic pancreatitis with associated autoimmune mechanism and difficulties in diagnosis. Focal AIP may mimic pancreatic cancer.*

Objective : *The purpose of this study was to determine the possible CT findings of the patients with AIP.*

Design : *Retrospective descriptive study.*

Setting : *King Chulalongkorn Memorial Hospital.*

Materials and Methods : *Retrospectively review of clinical presentations, laboratory data and CT findings with pancreatic protocol of 8 patients who were diagnosed with AIP between January 1st, 2000 and May 31st, 2012.*

Results : *All patients presented with jaundice and elevated serum IgG4 level. CT findings: diffuse (1of 8 patients, 12.5%) or focal (4 of 8 patients, 50%) pancreatic enlargement, normal pancreatic parenchymal enhancement (1 of 8 patients, 12.5%), abnormal pancreatic parenchymal enhancement (7 of 8 patients, 87.5%), normal pancreas (3 of 8 patients, 37.5%), loss of normal*

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pancreatic lobularity (3 of 8 patients, 37.5%), peripancreatic fat stranding (1 of 8 patients, 12.5%), positive "halo sign" (2 of 8 patients, 25%), diffuse pancreatic duct dilatation (2 of 8 patients, 25%), diffuse CBD dilatation with wall enhancement and thickening (2 of 8 patients, 25%), normal CBD with intrapancreatic bile duct dilatation with wall enhancement and thickening (1of 8 patients, 12.5%), diffuse CBD dilatation with stent insertion (3 of 8 patients, 37.5%), diffuse duct dilatation (1of 8 patients, 12.5%), normal CBD (1of 8 patients, 12.5%).

Conclusion : *CT findings of AIP showed classic appearances of diffuse pancreatic enlargement with loss of normal pancreatic lobularity, peripancreatic fat standing, and positive "halo" sign with pancreatic or CBD dilatation, or focal pancreatic enlargement. However, normal CT imaging of pancreasis one characteristic on CT imaging.*

Keywords: : *Autoimmune pancreatitis, AIP, CT.*

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เหตุผลของการทำวิจัย : *โรคตับอ่อนอักเสบที่เกิดจากภูมิต้านทานตัวเอง เป็นโรคที่พบได้ยาก เป็นรูปแบบหนึ่งของโรคตับอ่อนอักเสบเรื้อรัง ที่เกี่ยวกับภูมิต้านทานเอง และยากต่อการวินิจฉัย โรคตับอ่อนอักเสบที่เกิดจากภูมิต้านทานตัวเองเฉพาะที่ อาจคล้ายกับมะเร็งตับอ่อน*

วัตถุประสงค์ : *เพื่อศึกษาลักษณะของภาพเอกซเรย์คอมพิวเตอร์ที่เป็นไปได้ของผู้ป่วยที่ป่วยเป็นโรคตับอ่อนอักเสบที่เกิดจากภูมิต้านทานตัวเอง*

รูปแบบการวิจัย : *การศึกษาย้อนหลังเชิงพรรณนา*

สถานที่ทำการศึกษา : *โรงพยาบาลจุฬาลงกรณ์ สภากาชาดไทย*

ตัวอย่างและวิธีการศึกษา : *ศึกษาย้อนหลังถึงอาการแสดงทางคลินิก ผลการตรวจทางห้องปฏิบัติการ และภาพเอกเรย์คอมพิวเตอร์ของผู้ป่วยตับอ่อนอักเสบที่เกิดจากภูมิต้านทานตัวเอง 8 ราย ตั้งแต่ 1 มกราคม 2543 ถึง 31 พฤษภาคม 2555*

ผลการศึกษา : *ผู้ป่วยทุกรายมีอาการแสดงด้วยตัวเหลืองตาเหลือง และมีผลอิมมูโนโกลบูลิน G4 สูงในเลือด โดยลักษณะภาพเอกซเรย์คอมพิวเตอร์เป็นดังนี้: ตับอ่อนโตทั่วไป (1 ใน 8 ราย, 12.5%) ตับอ่อนโตเฉพาะที่ (4 ใน 8 ราย, 50%), parenchymal enhancement ของตับอ่อนปกติ (1 ใน 8 ราย, 12.5%), parenchymal enhancement ของตับอ่อนผิดปกติ (7 ใน 8 ราย, 87.5%), lobularity ของตับอ่อนปกติ (3 of 8 patients, 37.5%), สูญเสีย lobularity ของตับอ่อนปกติ (3 of 8 patients, 37.5%), peripancreatic fat stranding (1 ใน 8 ราย, 12.5%), "Halo sign" ให้ผลบวก (2 ใน 8 ราย, 25%), ท่อตับอ่อนโตทั่ว ๆ (2 ใน 8 ราย, 25%), ท่อน้ำดีโตทั่ว ๆ มีขอบหนาและ wall enhancement (2 ใน 8 ราย, 25%), ท่อน้ำดีนอกตับปกติแต่ท่อน้ำดีในตับโตทั่ว ๆ มีขอบหนาและ wall enhancement (1 ใน 8 ราย, 12.5%), ท่อน้ำดีโตทั่ว ๆ และใส่ stent (3 ใน 8 ราย, 37.5%), ท่อน้ำดีโตทั่ว ๆ (1 ใน 8 ราย, 12.5%), ท่อน้ำดีปกติ (1 ใน 8 ราย, 12.5%)*

สรุป : *ลักษณะภาพเอกซเรย์คอมพิวเตอร์ของโรคตับอ่อนอักเสบ ที่เกิดจากภูมิต้านทานตัวเองที่พบบ่อย คือ ตับอ่อนมีขนาดโตทั่ว ๆ สูญเสีย lobularity ของตับอ่อนปกติ ไขมันรอบตับอ่อนขุ่น และ "halo sign" ให้ผลบวกร่วมกับมีท่อตับอ่อนหรือท่อน้ำดีโต หรือพบว่าตับอ่อนโตเฉพาะที่ อย่างไรก็ตามลักษณะภาพเอกซเรย์คอมพิวเตอร์ของตับอ่อนปกติอาจพบได้ในโรคตับอ่อนอักเสบที่เกิดจากภูมิต้านทานตัวเองได้*

คำสำคัญ : *โรคตับอ่อนอักเสบที่เกิดจากภูมิต้านทานตัวเอง, AIP, เอกซเรย์คอมพิวเตอร์.*

Autoimmune pancreatitis (AIP) was first proposed by Yoshida *et al.* in 1995 to describe a form of chronic pancreatitis associated with autoimmune mechanism and effective respond to steroid therapy.[1] Autoimmune pancreatitis is a rare disease which is difficult to diagnosis because of their variations of clinical manifestations from nonspecific, mild to severe pancreatitis or presented with obstructive jaundice mimicking pancreatic malignancy.[2] Autoimmune pancreatitis accounts for 1.8% - 11% of all cases of chronic pancreatitis. [3] Many different terms have been used to determine autoimmune pancreatitis such as lymphoplasmacytic sclerosing pancreatitis, chronic sclerosing pancreatitis, pseudotumorous pancreatitis or nonalcoholic duct destructive chronic pancreatitis. [3, 4]

Many reports suggested that autoimmune pancreatitis was associated with other autoimmune conditions such as primary sclerosing cholangitis, primary biliary cirrhosis, ulcerative colitis, Crohn's disease, Sjögren's syndrome, rheumatoid arthritis and inflammatory bowel syndrome. [4,5]

Histologic finding of autoimmune pancreatitis is a collar-like periductal inflammation and infiltration of lymphocytes and plasma cells which is responsible for duct obstruction and focal duct destruction. [4,5]

Immunologic abnormality of autoimmune pancreatitis has important markers which include hypergammaglobulinemia and elevated serum IgG4 levels. [5] Serum IgG4 is the most sensitive and specific marker of autoimmune pancreatitis with a cut-off point at 135 mg/dL.[6]

The most common radiographic feature is diffuse enlargement of the pancreas, often described as "sausage-like" with homogenous attenuation and moderate enhancement.[5,6] Sometimes, it may present, however, as focal enlargement. [5,6] Endoscopic retrograde pancreatography (ERCP) of autoimmune pancreatitis patients shows focal, diffuse or segmental narrowing of the main pancreatic duct. [5,6]

Criteria diagnosis of autoimmune pancreatitis are: [1] imaging criteria and [2] elevated serum IgG4 levels or [3] histologic finding or [4] steroid response. [6]

Diagnosis of autoimmune pancreatitis is important because steroid treatment is dramatic response and effective with the possible complete regression of morphological changes and clinical symptoms. [4 - 6]

The purpose of this study was to determine the possible CT findings of the patients of AIP with pancreatic protocol.

Materials and Methods

Patient population

This study has been approved by the Research Ethic Committee of the Faculty of Medicine, Chulalongkorn University. Informed consent was waived due to the retrospective nature of the study.

This was a retrospective descriptive study. The populations enrolled into this study were patients with diagnosis of AIP by CT images, elevated serum IgG4 level, or histopathologic confirmation, which effective steroid response between January 1st, 2000 and May 31st, 2012. All patients underwent dual-phase pancreatic protocol CT with available clinical presentations, serum IgG4 level or histopathologic confirmation, and effective steroid response.

CT imaging acquisition and processing

CT scans were acquired on a 16-detector-row computed tomography (Somatom sensation 16, Siemens AG, Germany) using protocol of upper or whole abdomen with contrast enhanced portovenous phase. CT images of all patients were obtained craniocaudal direction from the level of the dome of diaphragm to the lower pole of kidney for upper abdomen protocol and from the dome of diaphragm to symphysis pubis for whole abdomen protocol with 16 × 1.5 mm collimation, a pitch of 1.0, 0.5 sec gantry rotation time at 160 mAs and 120 kV. The images were reviewed with 5 mm slice thickness with 3mm reconstruction interval.

Portovenous phase images were used to assess pancreatic and peripancreatic abnormality which acquired 100 ml intravenous administration of nonionic contrast material. Automated power injector at a flow rate of 3 - 5 ml/sec was used. The pancreatic, portovenous and delay phases were obtained with 20 - 30 seconds delay, 90 seconds delay and 5 minutes delay, respectively.

CT imaging analysis

Two reviewers (3rd year resident in Diagnostic Radiology and radiologist with 7-year experience in abdominal imaging) retrospectively reviewed all CT images using picture archiving and communication systems (PACS). The results were in consensus.

CT images were reviewed for the following characteristic on pancreatic parenchyma change, peripancreatic change, pancreatic duct and common bile duct (CBD) change, and other organ involvement.

As for the pancreatic parenchyma, we analyzed the followings: (a) diffuse or focal enlargement of the pancreatic parenchyma (the head, body, or tail of the pancreas); (b) degree of contrast enhancement of the pancreatic parenchyma on pancreatic, venous and delayed phases; (c) presence or absence of pancreatic lobularity; (d) presence or absence of tail cut-off sign, involution of the pancreatic tail.

As for the peripancreatic change, we analyzed the followings: (a) presence or absence of the peripancreatic fat stranding; (b) halo sign, a hypoattenuation rim surrounding the pancreas.

The data were analyzed using descriptive statistics.

Results

The summary of patient characteristics and CT findings is shown in Table 1, Table 2.

Patient characteristics

All of eight patients were male. The mean age was 62 years old (ranging from 23 to 76 years old).

Clinical symptoms at presentation were jaundice (n = 6, 75%), jaundice and abdominal pain (n = 1, 12.5%), and jaundice, abdominal pain and weight loss (n = 1, 12.5%). All patients had elevated serum IgG4. None of them had histopathologic confirmation.

CT imaging analysis

Pancreatic parenchymal change

Size

One of eight patients (12.5%) revealed diffuse pancreatic enlargement (Figure 1). Four of eight patients (50%) showed focal pancreatic enlargement at the head of pancreas (Figure 2). Three of eight patients (37.5%) showed no pancreatic enlargement.

Table 1. Patient Characteristics, Clinical Presentations, and Laboratory data.

Patient	Age	Gender	Clinical Presentations	IgG4 level (mg/dL)
1	66	M	Jaundice Abdominal pain Weight loss	1030
2	76	M	Jaundice	899
3	67	M	Jaundice	1160
4	57	M	Jaundice Abdominal pain	605
5	73	M	Jaundice	291
6	23	M	Jaundice	309
7	68	M	Jaundice	833
8	69	M	Jaundice	>1670

The pancreatic contrast enhancement

During the pancreatic phase, three of eight patients (37.5%) revealed homogeneous hypoattenuation. Three of eight patients (37.5%) showed homogeneous isoattenuation as compared to the liver which decreased normal pancreas enhancement. Two of eight patients (25%) showed homogeneous hyperattenuation, which is normal pancreas enhancement.

During venous phase, three of eight patients (37.5%) revealed homogeneous hypoattenuation. Five of eight patients (62.5%) showed homogeneous isoattenuation with normal enhancement.

The delayed phase was performed in four patients. Three of four patients (75%) revealed homogeneous isoattenuation. One of eight patients (12.5%) showed homogeneous hypoattenuation.

Lobularity and tail cutoff sign

Three of eight patients (37.5%) revealed loss of normal pancreatic lobularity. Five of eight (62.5%) patients showed normal pancreatic lobularity. None of the eight patients had tail cutoff sign.

Peripancreatic change

Peripancreatic fat stranding

One of eight patients showed peripancreatic fat standing.

Halo sign

Two of the eight patients revealed positive halo sign: one presented at 1- 3 mm surrounding the pancreas and the other showed at 4 – 6 mm.

Duct change

Diffuse pancreatic duct dilatation was observed in two of eight patients (25%). Six of eight (75%) showed normal pancreatic duct.

For CBD, two of eight patients (25%) revealed diffuse CBD dilatation with wall enhancement and thickening. One of eight patients (12.5%) presented normal CBD with intrapancreatic bile duct dilatation with wall enhancement and thickening. Three of eight patients (37.5%) showed diffuse CBD dilatation with stent insertion. One of eight patients (12.5%) revealed diffuse CBD dilatation. One of eight patients had normal CBD.

Table 2. CT findings

Patient	Pancreatic parenchymal change					Peripancreatic change			Duct change		Other
	Enlargement	Pancreatic	Venous phase	Delayed phase	Lobularity phase	Tail cutoff	Peripancreaticfat stranding	Halo sign	Pancreatic duct	Common bile duct	organ involvement
1	Head	Homogeneous hypoattenuation	Homogeneous Hypoattenuation	NP	Loss	Absent	Present	Present 4-6 mm	Normal	Diffuse dilatation with stent insertion	None
2	Diffuse	Homogeneous isoattenuation	Homogeneous isoattenuation	NP	Loss	Absent	Absent	Present 1-3 mm	Normal	Diffuse dilatation with wall enhancement and thickening	None
3	None	Homogeneous isoattenuation	Homogeneous isoattenuation	Homogeneous isoattenuation	Loss	Absent	Absent	Absent	Diffuse dilatation	Diffuse dilatation with wall enhancement and thickening	None
4	Head	Homogeneous hypoattenuation	Homogeneous hypoattenuation	Homogeneous hypoattenuation	Normal	Absent	Absent	Absent	Normal	Normal with intrapancreatic bile duct dilatation with wall enhancement and thickening	None
5	None	Homogeneous hyperattenuation	Homogeneous isoattenuation	Homogeneous isoattenuation	Normal	Absent	Absent	Absent	Normal	Normal	None
6	None	Homogeneous hyperattenuation	Homogeneous isoattenuation	NP	Normal	Absent	Absent	Absent	Normal	Diffuse dilatation with stent insertion	None
7	Head	Homogeneous hypoattenuation	Homogeneous hypoattenuation	NP	Normal	Absent	Absent	Absent	Diffuse dilatation	Diffuse dilatation	None
8	Head	Homogeneous isoattenuation	Homogeneous isoattenuation	Homogeneous isoattenuation	Normal	Absent	Absent	Absent	Normal	Diffuse dilatation with stent insertion	None

NP = not performed

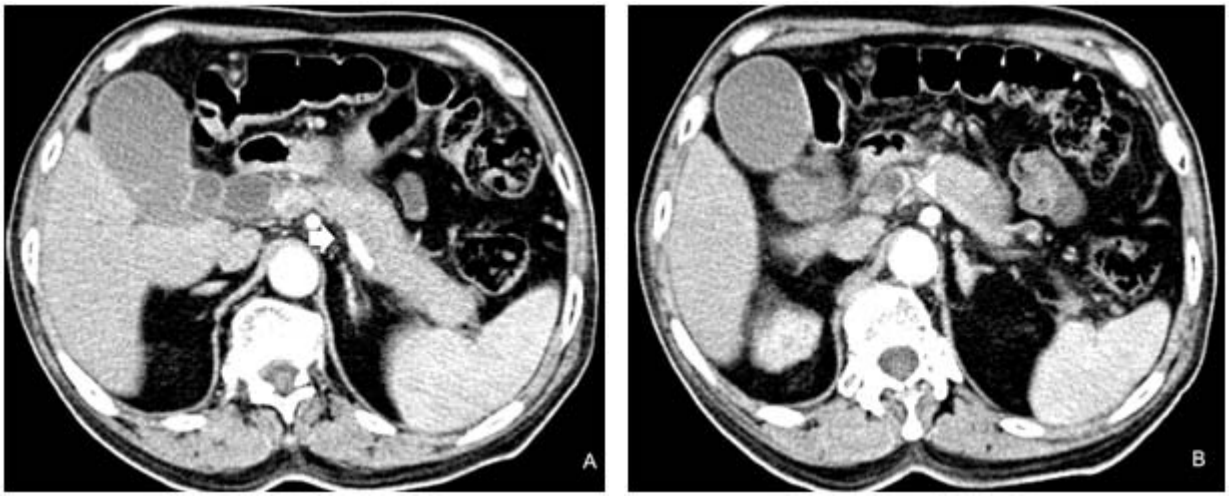

Figure 1. A 76 -year-old man presented with jaundice (Patient 2).
A and B, Contrast-enhanced axial CT scans show diffuse pancreatic enlargement, loss of normal pancreatic lobularity with positive "halo" sign at 1- 3 mm (arrow) and thickening and enhancing wall of diffuse CBD dilatation (arrowhead).

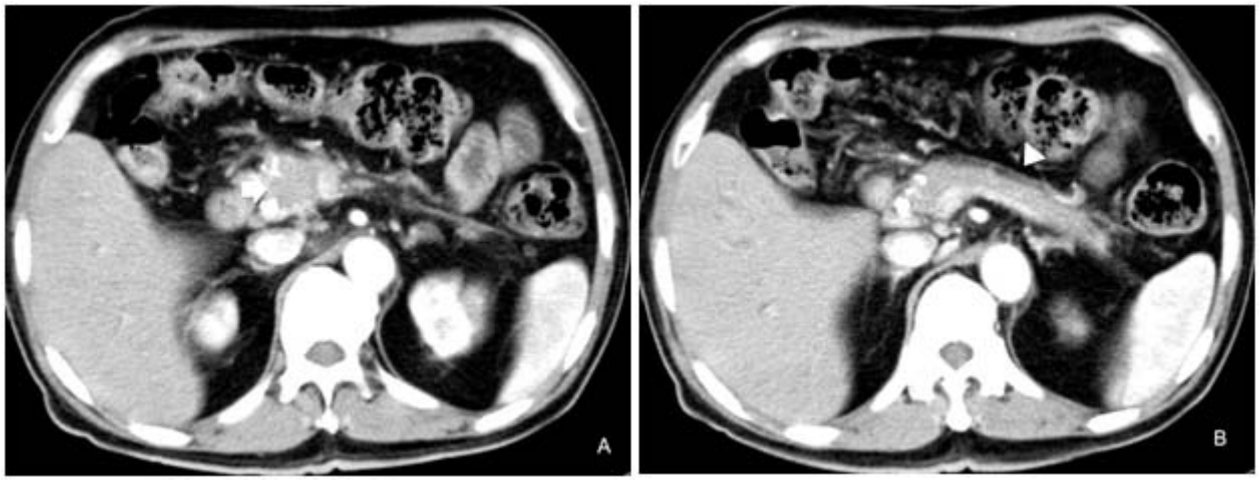

Figure 2. A 66-year-old man presented with jaundice, abdominal pain and weight loss (Patient 1).
A and B, Contrast-enhanced axial CT scans show focal pancreatic enlargement at pancreatic head (arrow), loss of normal pancreatic lobularity with positive "halo" sign at 4 - 6 mm (arrowhead) and peripancreatic fat stranding. Retained internal biliary drainage in CBD is seen.

Other organ involvement

None of the eight patients had other organ involvement.

Discussion

AIP was first described in 1995. [1] Nevertheless, AIP is still a rare disease and difficult to diagnosis. There are many proposed diagnostic criteria for AIP, the mostly used criteria included imaging, serologic, and pathologic criteria (e.g. the Japanese Pancreas Society in 2002 and revised in 2006 [7], the HISORt criteria of the Mayo Clinic [8]). According to many criteria, imaging of the pancreas is essential tool with laboratory and histologic findings, accompanied by steroid response. [2]

In our study, all of the eight patients were male. One patient was 23 years old. All of the eight patients had elevated serum IgG4. Seronegative AIP has been described in the study of Ghazale *et al.* [9], showing 24% of patients of AIP had normal serum IgG4. IgG4 can also be elevated in other conditions including pancreatic cancer. Therefore, this test may not always be specific for differentiating AIP from pancreatic cancer. [10]

Among the eight patients who presented with jaundice, only one patient had normal CT imaging. Since histopatholgic confirmation was not available in every case, the diagnosis of the aforementioned patient was made based upon elevated serum IgG4 and effective steroid response.

The classic characteristic on CT of AIP is diffuse enlargement of pancreas with a capsule-like rim [3, 4, 7, 11-13], which was observed only in one patient (12.5%).

In our study, 4 patients had focal pancreatic enlargement at the head of pancreas which was similar Robinson LS *et al.* study.[10] However, focal pancreatic enlargement of the head of pancreas can mimic pancreatic cancer. Both pancreatic duct and common bile duct changes in AIP may be not uncommon findings but nonspecific. The clue that helps differentiating AIP from pancreatic cancer is pancreatic duct dilatation, mostly caused by pancreatic cancer. The associated finding of focal pancreatic enlargement at the head of pancreas in patients with AIP in our study was CBD dilatation.

The abnormal enhancement of pancreas in any phases may suggest pancreatic abnormality but not specific in diagnosis of AIP.

Loss of normal pancreatic lobularity showed three in eight patients (37.5%) in our study, this findings may lead to the diagnosis of AIP.

Limitations of our study included retrospective nature of this study, small number of cases which limited the use of statistical analysis, and comparison with previous studies.

Conclusion

CT findings of AIP showed classic appearances of diffuse pancreatic enlargement with loss of normal pancreatic lobularity, peripancreatic fat standing, and positive “halo” sign with pancreatic or CBD dilatation, or focal pancreatic enlargement. However, normal CT imaging of pancreasis one characteristic on CT imaging.

Conflict of interest : We hereby declare no conflict of interest.

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