Imaging manifestations of autoimmune pancreatitis

e-Poster: S3343

Congress: ESGAR2017

Type: Educational Exhibit

Topic: Pancreas Diffuse Disease

Authors: N. Sivarasan, C. Tang, S. Gourtsoyianni, N. Griffin; London/GB

MeSH:

Pancreas [A03.734]

Autoimmune Diseases [C20.111]

Pancreatitis [C06.689.750]

Any information contained in this pdf file is automatically generated from digital material submitted to e-Poster 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 ESGAR's endorsement, sponsorship or recommendation of the third party, information, product, or service. ESGAR 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 ESGAR 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.esgar.org
1. Learning objectives

Autoimmune pancreatitis (AIP) is a rare form of chronic pancreatitis secondary to an immune-mediated fibroinflammatory process, which responds to corticosteroid therapy. AIP may be clinically and radiologically difficult to distinguish from ductal pancreatic adenocarcinoma and lymphoma, and it is therefore important to consider it as possible differential in order to facilitate appropriate management.

The aims of this poster are as follows:

• Discuss the aetiology, clinical features, histopathology and systemic associations of AIP.
• Review the imaging characteristics of pancreatic and extra-pancreatic manifestations of AIP within the abdomen on cross-sectional imaging.

2. Background

AIP was first described as a pancreatitis of autoimmune aetiology in 1995 by Yoshida et al. It is a rare disorder, although the lack of prospective studies means the true incidence is currently unknown. A study based in Japan estimated the prevalence to be 0.82 per 100,000 with a 2.85:1 male:female ratio.

More recently, AIP has been sub-divided into Type 1 and Type 2, mainly based on histological differences.

1) Type 1 AIP is a manifestation of a systemic IgG-4 disease, as evidenced by the presence of histologically identical synchronous or metachronous lesions in other organs (e.g. salivary glands, bile ducts and kidneys). Type 1 patients are typically older (sixth decade), more often males and usually present with painless obstructive jaundice and an elevated serum IgG 4.

2) Type 2 AIP is not IgG-4 mediated and is therefore typically isolated to the pancreas, although it does have a known association with chronic inflammatory bowel disease. Type 2 AIP typically affects younger patients (fourth decade), is equally prevalent in men and women and presents with either painless obstructive jaundice or the more conventional symptoms of pancreatitis (abdominal pain, weight loss and steatorrhoea). The serum IgG4 is notably normal in this subset of patients.

Histologically these patients typically have a granulocytic epithelial lesion (GEL) where there is focal disruption and destruction of the duct epithelium due to the invasion of neutrophilic granulocytes. GELS affect medium - sized and small ducts. There are also absent or scant (<10 cells/HPF) IgG4-positive staining plasma cells in the inflamed pancreatic tissue.

Both subtypes respond well to corticosteroids, with radiological improvement seen within two weeks, although there is a higher rate of recurrence in Type 1 patients, who are believed to benefit from long-term low-dose steroids.
Diagnostic Criteria

The International Consensus Diagnostic Criteria (ICDC) was released in 2011. This includes five major diagnostic criteria:

1) Imaging findings – parenchymal and ductal changes
2) Serology
3) Histology
4) Other Organ Involvement
5) Response to Steroids

3. Imaging Findings/Procedure Details

We present the main pancreatic and abdominal extra-pancreatic findings of AIP on cross-sectional imaging. The key differentials for AIP include pancreatic ductal carcinoma, chronic pancreatitis, acute oedematous pancreatitis and lymphoma; these all have markedly different treatments, and therefore accurate diagnosis is essential to direct appropriate management.

Pancreatic Findings

The morphological appearance of Type 1 and 2 AIP are radiologically indistinguishable.

AIP may either present as a diffuse form or a more focal form:

- **Diffuse Form**: Smooth, sausage-like enlargement of the pancreas with loss of the normal pancreatic lobulations.
• **Focal Form:** Focal enlargement, typically within the pancreatic head or uncinate process.

In both forms, there is an absence of inflammation, pseudocysts, peri-pancreatic collections and pancreatic calcification and the lack of these features can help to differentiate AIP from chronic pancreatitis.

**CT**

• There may be reduced enhancement of affected parenchyma during the arterial phase, with delayed enhancement seen subsequently.

• Lymphadenopathy is often present.

• **Characteristic hypodense capsule seen surrounding the pancreas.**

• **Strictures of the pancreatic duct may also be appreciated on CT.**

**Figure 1a**

![Figure 1a: CECT showing example of diffuse AIP with sausage shaped configuration to pancreas (arrows).](image-url)
MRI

- The affected parenchyma usually appears T1w hypointense and T2w hyperintense.

- Similar to CT appearances. There is typically delayed enhancement post-contrast.

- The peripheral capsule appears T2w hypointense and also demonstrates delayed enhancement.

- On diffusion weighted sequences, there is restricted diffusion related to the affected site. This is either diffuse, solitary or multiple in patients with AIP, compared to pancreatic cancer where restricted diffusion is always focal. The apparent diffusion coefficient (ADC) values within the pancreas are also significantly lower in AIP than in pancreatic cancer or normal individuals.\(^\text{10}\)

- If MRCP is performed, discontiguous pancreatic duct strictures are readily appreciated. The degree of upstream dilatation is less marked than that seen in pancreatic cancer.
Figure 2a: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. Axial T2FS HASTE image shows intermediate to high T2 signal within the pancreas (arrows), but extensive low T2 signal peripancreatic tissue (*).
Figure 2b: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. Axial T1FS postcontrast arterial phase initially shows reduced enhancement of the peripancreatic tissue (*) compared to the pancreas (arrows).
Figure 2c: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. Axial T1FS postcontrast equilibrium phase showing delayed enhancement of the peripancreatic tissue. The delayed enhancement is a typical finding in AIP (compared to lymphoma which was a differential in this patient before biopsy diagnosis).
**Figure 2d**

Figure 2d: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. The pancreas and extrapancreatic soft tissue shows marked restricted diffusion with high signal on DWI - B800 (arrows), a typical finding in AIP.

---

**Figure 2e**

Figure 2e: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. The pancreas and extrapancreatic soft tissue shows marked restricted diffusion with corresponding low signal on ADC (arrows).
Figure 2f: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. Only the extrapancreatic soft tissue shows high grade FDG uptake (arrows), a finding which was felt to be atypical for lymphoma.

**FDG-PET/CT**

- This may also have utility, as AIP typically has FDG avidity, with diffuse uptake seen within the affected part of the pancreas. However, this will not help distinguish it from other differentials.

- FDG-PET/CT is useful for identifying extra-pancreatic sites of disease and can also be used in monitoring response to treatment, with studies showing resolution of abnormal FDG uptake. ¹¹
Figure 3: Coronal FDG-PET/CT study showing multifocal IgG4 disease with involvement of the right lung, tail of the pancreas and retroperitoneum (arrows).

**Ultrasound**

- *Trans-abdominal ultrasound* is of limited use as it may not identify any abnormality.

- *Endoscopic ultrasound (EUS)* may identify the sausage-shaped pancreas typical of AIP (which appears hypoechoic), in addition to visualising any strictures within the pancreatic duct. EUS can also be used to obtain a histological diagnosis.

**Extra-pancreatic Abdominal Findings**

As stated above, extra-pancreatic findings of AIP are exclusive to Type 1 disease, although Type 2 is notably associated with IBD.

**Biliary**

*Biliary involvement is seen in the majority (up to 90%) of patients with AIP, presenting in the form of IgG-4 cholangitis. This is characterized by:*
• Thickening and strictureing of bile duct walls, and can affect both the intrahepatic and extrahepatic biliary tree.

• Strictures are usually long and smooth in morphology, with associated upstream dilatation.

• On CT imaging, the affected bile duct walls demonstrate hyperenhancement post-contrast, with corresponding hyperenhancement also seen on post-contrast T1w sequences on MRI.

Figure 4a: Example of IgG4 biliary stricture: Coronal True FISP shows a tight stricture (arrow) in the distal CBD with dilatation of the intra and extrahepatic bile ducts. The pancreas is also diffusely enlarged and sausage shaped (*).
Figure 4b: Coronal True FISP on above patient (Figure 4a) from an MRI study repeated several months later showing spontaneous resolution of the previous distal CBD stricture and reduced bulk of the pancreas (*). There is no longer biliary dilatation.
Figure 5a: Example of IgG4 related biliary stricture in a different patient with strictures seen in the common hepatic duct and distal CBD (arrows).
Figure 5b: ERCP performed 6 months later in same patient as above (figure 5a) showing resolution of the extrahepatic strictures after treatment with corticosteroids.

Renal

Renal involvement is also frequently seen with AIP, with parenchymal involvement seen in around 30% of patients. Common manifestations include:

- Generalised renal enlargement.

- Low density parenchymal lesions (either wedge-shaped or rounded).

- Development of a perirenal soft tissue rind.
Figure 6a: Example of IgG4 disease affecting the left kidney. Axial CECT shows typical wedge-shaped low density renal cortical lesions in the left kidney (arrows). Both kidneys are stented as there was also IgG4 related retroperitoneal fibrosis.
Figure 6b: Example of IgG4 disease affecting the left kidney. Coronal FDG-PET/CT in same patient as above (Figure 6a) showing multifocal high grade uptake in the left kidney (arrow).
Figure 7a: Example of extrarenal IgG4 disease: CECT showing a rind of abnormal soft tissue anterior to the right kidney and encasing the IVC (*). There is abnormal soft tissue extending around the gallbladder (GB) also.
Figure 7b: Example of extrarenal IgG4 disease: Axial T2 HASTE in same patient as above (Figure 7a) shows perirenal soft tissue is of low T2 signal (*).
Figure 7c: Example of extrarenal IgG4 disease: Axial T1FS pre-contrast shows perirenal soft tissue of intermediate T1 signal (*).
Figure 7d: Example of extrarenal IgG4 disease: Axial T1FS post-contrast arterial phase shows minimal enhancement of the perirenal soft tissue (*).
Figure 7e: Example of extrarenal IgG4 disease: Axial T1FS post-contrast equilibrium phase shows delayed enhancement related to a cuff of soft tissue around the IVC (arrow) with most of the perirenal soft tissue remaining low T1 signal (*).
Figure 7f: Example of extrarenal IgG4 disease. The enhancing tissue around the IVC shows restricted diffusion with high signal on DWI - B800 (arrows).
Figure 7g: Example of extrarenal IgG4 disease. The enhancing tissue around the IVC shows restricted diffusion with corresponding low ADC (arrows).

Retroperitoneal Fibrosis

• AIP is also known to have an association with retroperitoneal fibrosis (estimated in 10% of patients).¹³

• This presents as a retroperitoneal mass which encases the aorta and may cause hydronephrosis secondary to extrinsic compression of the ureters.
Figure 8a: Example of IgG4 retroperitoneal fibrosis. Axial CECT showing enhancing soft tissue partly encasing the IVC and aorta (arrows).
Figure 8b: Example of IgG4 retroperitoneal fibrosis. Axial FDG-PET/CT showing increased FDG uptake in the abnormal retroperitoneal soft tissue (arrows).
Figure 8c: Example of IgG4 retroperitoneal fibrosis. Axial CECT in same patient as above, with reduced periaortic soft tissue, following treatment with corticosteroids.
4. Conclusion

AIP is an increasingly recognised entity, characterised by diffuse or focal enlargement of the pancreas and associated stricture formation within the pancreatic duct, with delayed enhancement of affected pancreatic parenchyma. More recently, AIP has been histologically classified into Type 1 and Type 2 AIP, with the former associated with raised IgG-4 levels and extra-pancreatic manifestations (particularly the biliary tree and kidneys). AIP readily responds to corticosteroid therapy, and therefore it is essential to correctly distinguish it from entities with similar appearances, such as pancreatic cancer or lymphoma, which require radically different management.

5. References


6. Author Information

Dr Nishanth Sivarasan - Radiology Registrar, Guy’s and St Thomas’ Hospital, London

Dr Chris Tang - Radiology Registrar, Guy’s and St Thomas’ Hospital, London

Dr Sofia Gourtsoyianni - Consultant GI Radiologist, Guy’s and St Thomas’ Hospital, London

Dr Nyree Griffin - Consultant GI Radiologist, Guy’s and St Thomas’ Hospital, London
7. Mediafiles

Figure 1a

*Figure 1a: CECT showing example of diffuse AIP with sausage shaped configuration to pancreas (arrows).*
Figure 1b: CECT in a different patient showing example of focal AIP affecting the distal body and tail of pancreas, which appears slightly hypodense to the head of pancreas (arrows).
Figure 2a: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. Axial T2FS HASTE image shows intermediate to high T2 signal within the pancreas (arrows), but extensive low T2 signal peripancreatic tissue (*).
Figure 2b: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. Axial T1FS postcontrast arterial phase initially shows reduced enhancement of the peri-pancreatic tissue (*) compared to the pancreas (arrows).
Figure 2c: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. Axial T1FS postcontrast equilibrium phase showing delayed enhancement of the peripancreatic tissue. The delayed enhancement is a typical finding in AIP (compared to lymphoma which was a differential in this patient before biopsy diagnosis).
Figure 2d: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. The pancreas and extrapancreatic soft tissue shows marked restricted diffusion with high signal on DWI - B800 (arrows), a typical finding in AIP.

Figure 2e: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. The pancreas and extrapancreatic soft tissue shows marked restricted diffusion with corresponding low signal on ADC (arrows).
Figure 2f: Patient with history of MALT lymphoma, presenting with raised serum IgG4 and diagnosis of AIP on EUS guided biopsy. Only the extrapancreatic soft tissue shows high grade FDG uptake (arrows), a finding which was felt to be atypical for lymphoma.
Figure 3: Coronal FDG-PET/CT study showing multifocal IgG4 disease with involvement of the right lung, tail of the pancreas and retroperitoneum (arrows).
Figure 4a: Example of IgG4 biliary stricture: Coronal True FISP shows a tight stricture (arrow) in the distal CBD with dilatation of the intra and extrahepatic bile ducts. The pancreas is also diffusely enlarged and sausage shaped (*).
Figure 4b: Coronal True FISP on above patient (Figure 4a) from an MRI study repeated several months later showing spontaneous resolution of the previous distal CBD stricture and reduced bulk of the pancreas (*). There is no longer biliary dilatation.
Figure 5a

Figure 5a: Example of IgG4 related biliary stricture in a different patient with strictures seen in the common hepatic duct and distal CBD (arrows).
Figure 5b: ERCP performed 6 months later in same patient as above (figure 5a) showing resolution of the extrahepatic strictures after treatment with corticosteroids.
Figure 6a: Example of IgG4 disease affecting the left kidney. Axial CECT shows typical wedge-shaped low density renal cortical lesions in the left kidney (arrows). Both kidneys are stented as there was also IgG4 related retroperitoneal fibrosis.
Figure 6b: Example of IgG4 disease affecting the left kidney. Coronal FDG-PET/CT in same patient as above (Figure 6a) showing multifocal high grade uptake in the left kidney (arrow).
Figure 7a: Example of extrarenal IgG4 disease: CECT showing a rind of abnormal soft tissue anterior to the right kidney and encasing the IVC (*). There is abnormal soft tissue extending around the gallbladder (GB) also.
Figure 7b: Example of extrarenal IgG4 disease: Axial T2 HASTE in same patient as above (Figure 7a) shows perirenal soft tissue is of low T2 signal (*).
Figure 7c: Example of extrarenal IgG4 disease: Axial T1FS pre-contrast shows perirenal soft tissue of intermediate T1 signal (*).
Figure 7d: Example of extrarenal IgG4 disease: Axial T1FS post-contrast arterial phase shows minimal enhancement of the perirenal soft tissue (*).
Figure 7e: Example of extrarenal IgG4 disease: Axial T1FS post-contrast equilibrium phase shows delayed enhancement related to a cuff of soft tissue around the IVC (arrow) with most of the perirenal soft tissue remaining low T1 signal (*).
Figure 7f: Example of extrarenal IgG4 disease. The enhancing tissue around the IVC shows restricted diffusion with high signal on DWI - B800 (arrows).
Figure 7g: Example of extrarenal IgG4 disease. The enhancing tissue around the IVC shows restricted diffusion with corresponding low ADC (arrows).
Figure 8a: Example of IgG4 retroperitoneal fibrosis. Axial CECT showing enhancing soft tissue partly encasing the IVC and aorta (arrows).
Figure 8b: Example of IgG4 retroperitoneal fibrosis. Axial FDG-PET/CT showing increased FDG uptake in the abnormal retroperitoneal soft tissue (arrows).
Figure 8c: Example of IgG4 retroperitoneal fibrosis. Axial CECT in same patient as above, with reduced periaortic soft tissue, following treatment with corticosteroids.
Figure 8d: Example of IgG4 retroperitoneal fibrosis. Corresponding T1FS post-contrast MRI showing residual enhancing soft tissue around the aorta following steroid treatment (arrows).

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Type 1 AIP</th>
<th>Type 2 AIP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Young (4th decade)</td>
<td>Older (6th decade)</td>
</tr>
<tr>
<td>Gender</td>
<td>Male predominance</td>
<td>Male = Female</td>
</tr>
<tr>
<td>Clinical Presentation</td>
<td>Obstructive Jaundice</td>
<td>Obstructive Jaundice Abdominal Pain/Acute pancreatitis</td>
</tr>
<tr>
<td>Serum IgG4</td>
<td>Usually elevated</td>
<td>Normal</td>
</tr>
<tr>
<td>Histology</td>
<td>IgG-4 rich periductal lymphoplasmocytic infiltrates</td>
<td>Granulocyte epithelial lesions (GEL)</td>
</tr>
<tr>
<td>Extra-pancreatic Involvement</td>
<td>Proximal bile duct, salivary gland, kidney, retroperitoneum</td>
<td>None</td>
</tr>
<tr>
<td>Associated with Ulcerative Colitis</td>
<td>Occasional</td>
<td>Common</td>
</tr>
<tr>
<td>Steroid Response</td>
<td>Excellent</td>
<td>Excellent</td>
</tr>
<tr>
<td>Recurrence</td>
<td>Common</td>
<td>Rare</td>
</tr>
</tbody>
</table>

Summary of clinical features and histopathology in AIP. As adapted from Kemisawa et al. 8.