

High-Resolution Pancreaticobiliary MR Imaging with MAGNETOM Cima.X: Two Cases of IgG4-Related Diseases

Yitong Lu¹, Bowen Wu¹, Yueluan Jiang², Xiaoye Wang³, Liang Zhu¹

¹Department of Radiology, Peking Union Medical College Hospital, Beijing, China

²MR Research Collaboration Team, Siemens Healthineers Ltd., Beijing, China

³MR Clinical Marketing, Siemens Healthineers Ltd., Beijing, China

Introduction

IgG4-related disease (IgG4-RD) is a rare autoimmune disorder that can involve multiple organs. The clinical manifestation and radiological appearance of pancreaticobiliary system involvement often closely mimics pancreatic cancer or cholangiocarcinoma, which may lead to unnecessary surgical resections. Accurate differentiation between IgG4-RD and pancreaticobiliary malignancies is therefore essential for appropriate treatments.

Recent advances in magnetic resonance imaging (MRI), particularly with the development of ultra-high-gradient systems and deep learning reconstruction, provide superior spatial resolution and contrast compared to conventional systems. This enables the detection of subtle imaging features, such as the duct-penetrating sign of the pancreas, and symmetric thickening and diffusion restriction of the biliary wall, which provide important clues for an accurate diagnosis.

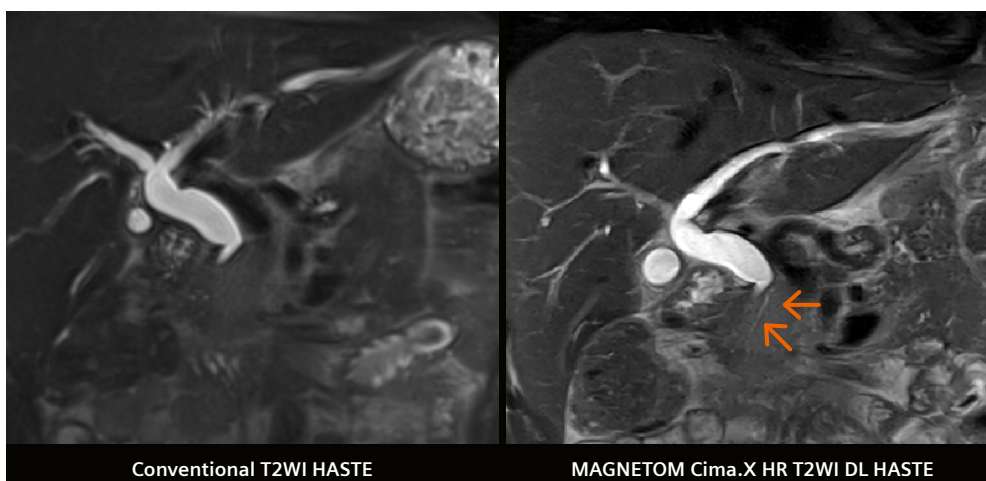
In this report, we present two cases of IgG4-related autoimmune pancreatitis with or without associated sclerosing cholangitis, where high-resolution images from the 3T MAGNETOM Cima.X provided critical diagnostic information and enabled accurate distinction from malignancy.

Case 1

Patient history

A 49-year-old male presented with obstructive jaundice for a week, and a history of intermittent abdominal bloating for six months. Initial MRI from an external institution revealed a mass in the pancreatic head with a “double-duct sign.” Serum CA 19-9 was slightly increased (40.1 U/mL). The patient was suspected of having pancreatic head carcinoma and referred to our hospital for further workup.

At our institution, contrast-enhanced CT revealed a soft-tissue mass in the pancreatic head with a “double-duct sign,” while PET/CT demonstrated increased FDG uptake of the pancreatic head lesion (SUVmax 8.9). Serum IgG4 was within normal range (791 mg/L). With a preliminary diagnosis of pancreatic head mass with obstructive jaundice, this case was presented for discussion in the pancreatic multidisciplinary team (MDT). Based on the clinical history and imaging findings, atypical focal autoimmune pancreatitis (AIP) was suspected, and high-resolution contrast-enhanced pancreatic MRI and MR cholangiopancreatography (MRCP) were suggested.



1 High-resolution DL HASTE T2-weighted imaging (right) clearly demonstrates the pancreatic duct-penetrating sign.

Imaging findings

MR imaging from the 3T MAGNETOM Cima.X revealed the following:

Coronal high-resolution deep learning T2-weighted imaging (HR DL T2WI) demonstrated a narrowed but non-obstructed main pancreatic duct (MPD) traversing the pancreatic head mass. This is the “duct-penetrating sign,” and it favors AIP over pancreatic carcinoma (Fig. 1).

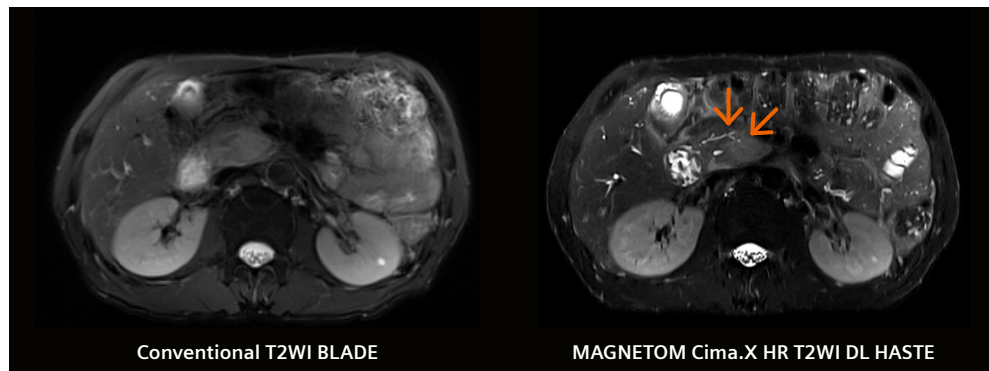
Axial HR DL HASTE T2WI clearly depicted the Santorini’s duct, which was spared from the pancreatic head lesion. Such details were not shown on conventional BLADE T2WI (Fig. 2).

DL ZOOMit DWI showed a sharply delineated hyperintense lesion in the pancreatic head, corresponding to

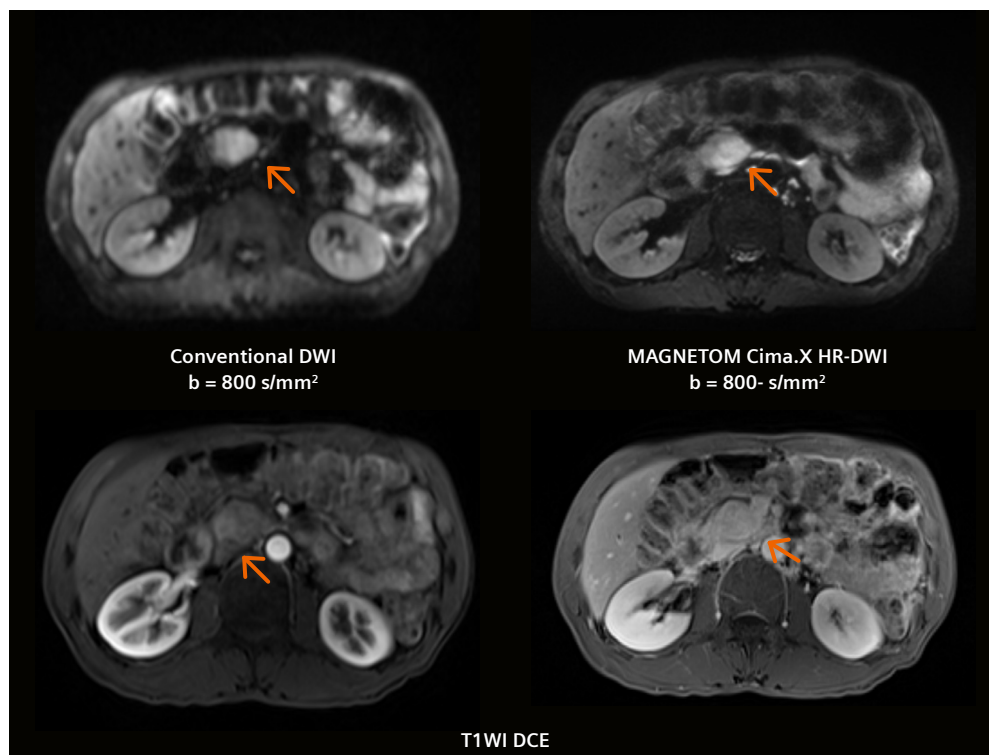
heterogeneous hypo-enhancement in the pancreatic arterial phase and homogeneous hyper-enhancement in the delayed phase, consistent with focal AIP (Fig. 3).

Diagnosis and outcome

According to the information from high-resolution MRI, the diagnosis was probable seronegative IgG4-related autoimmune pancreatitis. Further pancreatic biopsy revealed chronic pancreatitis with >10 IgG4+ plasma cells/high-power field (HPF), consolidating the diagnosis. After four weeks of corticosteroid therapy (CST), the patient’s jaundice was resolved, and follow-up MRI demonstrated regression of the lesion and resolved biliary obstruction.



2 High-resolution DL HASTE T2-weighted imaging (right) clearly demonstrates the accessory pancreatic duct.



3 High-resolution DL ZOOMit DWI (top right) clearly delineates the lesions in the pancreatic head.



“Upper abdominal MRI is inherently challenging, and hardware performance is essential for consistently achieving diagnostic-quality images. While ductal dilatation is relatively easy to depict, subtle features such as a narrowed but non-obstructed MPD penetrating the mass, or fine biliary wall changes, are significantly more challenging for imaging techniques. The ultra-high-gradient performance of the MAGNETOM Cima.X, combined with deep learning-based reconstruction, delivers high-resolution T2WI and DWI that is unobtainable with conventional MRI. These advances could greatly enhance the performance of MRI and provide a powerful problem-solving tool for clinical doctors.”

Professor Feng Feng,

Department of Radiology, Peking Union Medical College Hospital, Beijing, China

Case 2

Patient history

A 69-year-old male presented with generalized pruritus following medication for conjunctivitis. Liver function tests showed elevated liver enzymes and bilirubin levels (ALT 308 U/L, AST 139 U/L, GGT 546 U/L, ALP 261 U/L, TBil 28.6 μ mol/L). His serum CA 19-9 level fluctuated between 26 and 36 U/mL, while his carcinoembryonic antigen (CEA) level was mildly elevated (5.8 ng/mL). CT and MRI suggested distal common bile duct stricture, pancreatic head enlargement, and main pancreatic duct dilatation. Endoscopic ultrasound demonstrated common bile duct wall thickening.

Based on the abovementioned information from the external institution, the consulting gastroenterologist raised suspicion for IgG4-related autoimmune pancreatitis and sclerosing cholangitis. Serum IgG4 was markedly elevated (6213 mg/dL). High-resolution MRI and MRCP were requested to rule out pancreaticobiliary malignancies.

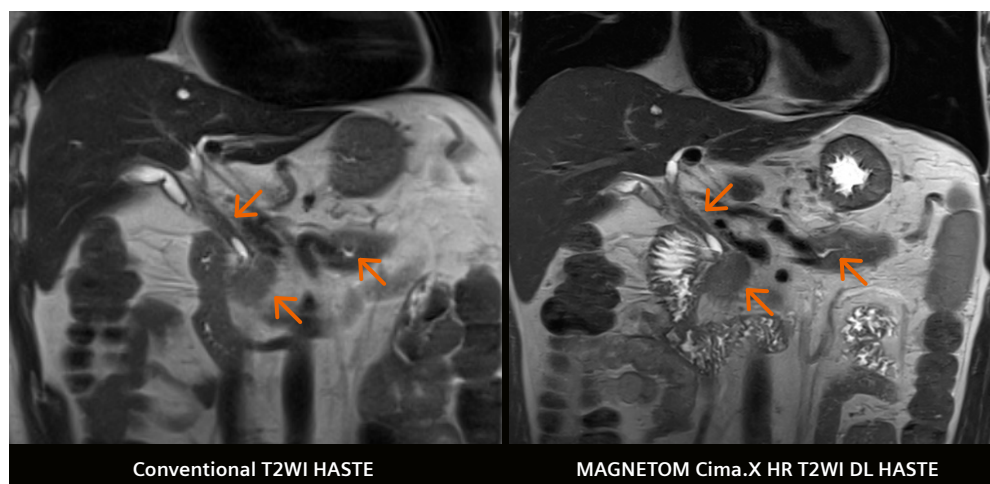
Imaging findings

MR imaging from the 3T MAGNETOM Cima.X revealed the following:

Compared with conventional HASTE T2WI, the HR DL T2WI more clearly revealed biliary wall thickening, pancreatic head swelling, and subtle main pancreatic duct dilatation in the body (Fig. 4).

On HR-DL T2WI, the irregularity and slight dilation of the MPD in the pancreatic body and tail was more clearly seen than on the conventional BLADE (Fig. 5).

Conventional DWI showed tape-like hyperintensity along the common bile duct and cystic duct region. HR DL ZOOMit DWI demonstrated sharply delineated “tram-track” and ring-like hyperintensity, which was precisely confined to the thickened biliary wall. The image pattern of diffusion restriction corresponds perfectly to hyperenhancement of the biliary wall on contrast-enhanced sequences (Fig. 6).

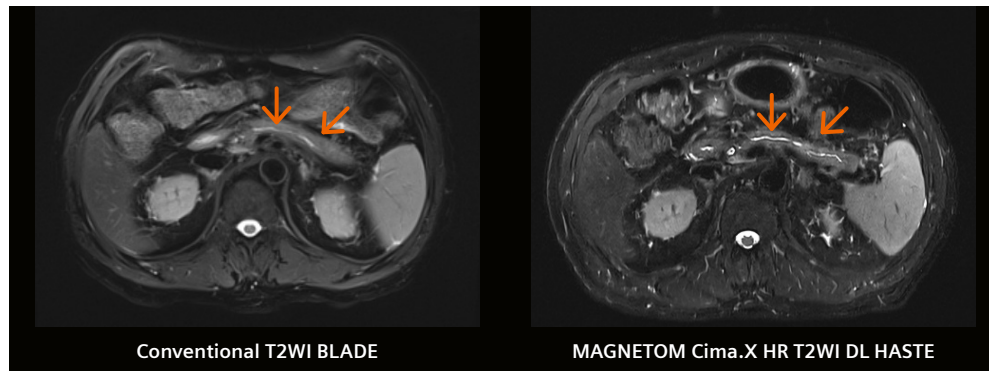


4 High-resolution DL-T2WI (right) clearly shows the thickening of the main bile duct wall.

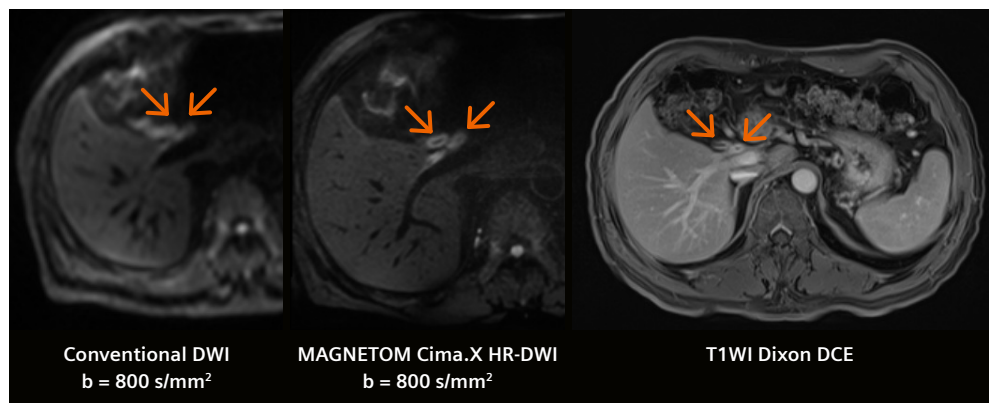
Diagnosis and outcome

The diagnosis was IgG4-related autoimmune pancreatitis with associated sclerosing cholangitis. After four weeks of

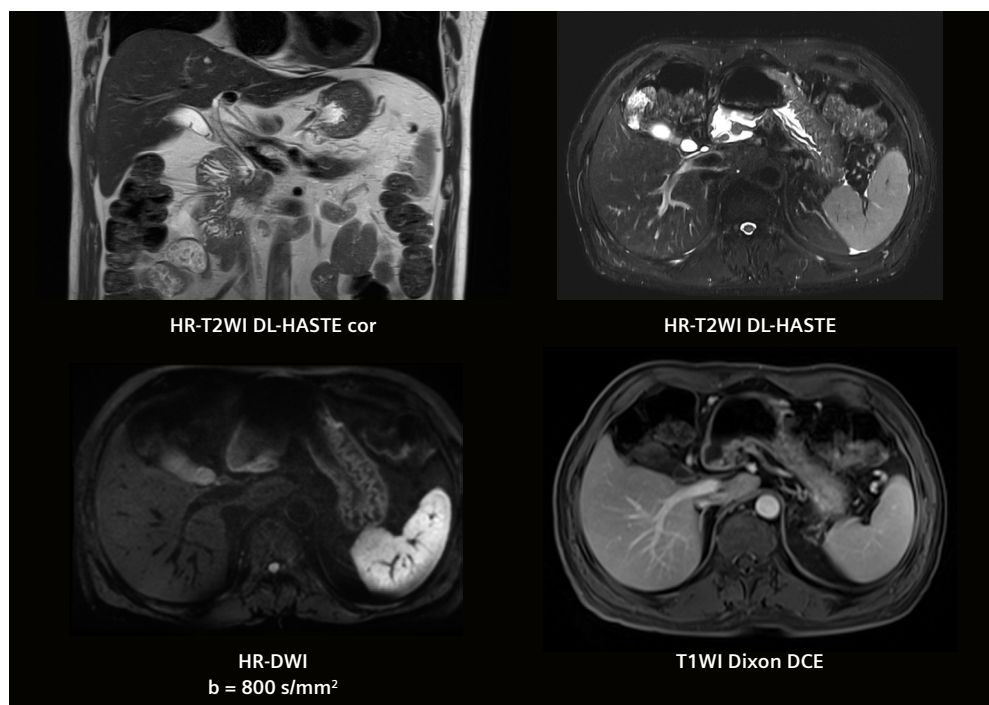
CST, follow-up high-resolution MRI showed dramatic regression of both pancreatic and biliary abnormalities (Fig. 7).



5 High-resolution DL T2WI (right) clearly demonstrates morphological abnormalities in the pancreatic duct.



6 High-resolution DL T2WI (right) clearly demonstrates morphological abnormalities in the pancreatic duct.



7 Posttreatment MRI.

	Con T2WI cor	HR T2WI cor	Con T2WI ax	HR T2WI ax	Conv DWI	HR DWI
Field of view (mm ³)	360 × 360	400 × 400	360 × 360	380 × 309	380 × 309	300 × 208
Matrix	320 × 320	448 × 358	320 × 320	384 × 269	128 × 128	150 × 150
Spatial resolution (mm ³)	1.1 × 1.1 × 4.0	0.45 × 0.45 × 4.0	1.1 × 1.1 × 6.0	0.5 × 0.5 × 3.0	1.5 × 1.5 × 4.0	1.0 × 1.0 × 3.0
Slices	32	32	25	48	38	48
Echo time (ms)	92	87	85	89	56	50
Repetition time (ms)	2000	567	2390	666	2000	2400
Averages	1	1	1	1	1, 4	1, 8
Diffusion gradients	–	–	–	–	3	3
B values (s/mm ²)	–	–	–	–	50, 800	50, 800
Bandwidth (Hz/pixel)	710	657	710	420	2298	1960
Acquisition time (min:s)	1:30	0:18	3:00	0:42	2:04	3:20
Fat suppression	–	–	SPAIR	SPAIR	SPAIR	Fat saturation
DL reconstruction	–	On	–	On	–	On
Sequence	HASTE	HASTE	BLADE	HASTE	SE-EPI	ZOOMit SE-EPI
Scanner	MAGNETOM Skyra	MAGNETOM Cima.X	MAGNETOM Skyra	MAGNETOM Cima.X	MAGNETOM Skyra	MAGNETOM Cima.X
Interpolation	Off	On	Off	On	On	On
Resp. control	Trigger	Breath-hold	Trigger	Breath-hold	Trigger	Trigger
Acceleration factor	3	4	2	4	2	2
Acceleration mode	GRAPPA	GRAPPA	GRAPPA	GRAPPA	SMS, GRAPPA	GRAPPA

Table 1: Examination protocol: Con = conventional, HR = high resolution, DL = deep learning, cor = coronal, ax = axial

Discussion

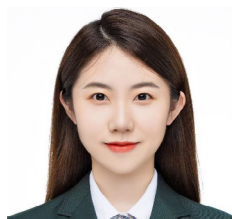
Both cases highlight the critical role of ultra-high-gradient MRI in differentiating IgG4-related disease from pancreaticobiliary malignancies. Conventional MRI and CT may demonstrate mass-like lesions with upstream MPD and biliary dilatation, mimicking malignancy. The hypermetabolism of the lesion with active inflammation may be even more misleading. However, the diagnostic clues for autoimmune pancreatitis – such as the subtle duct changes and

multi-focal involvement – require high-resolution imaging for confident identification.

The MAGNETOM Cima.X, equipped with a 200 mT/m amplitude and a 200 T/m/s slew rate, enables high-resolution T2WI and DWI with deep learning reconstruction. This permits clear visualization of subtle pancreatic parenchymal signal intensity, ductal morphology, and biliary wall alterations, which is critical for distinguishing IgG4-RD from malignancies.

Contact

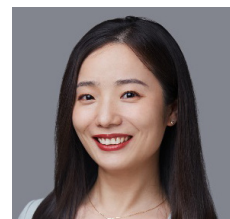
Liang Zhu, M.D.
Associate Professor, Department of Radiology
Peking Union Medical College Hospital
Shuaifuyuan No. 1, Dongcheng District
Beijing, 100730
China
zhuliang_pumc@163.com



Yitong Lu, Radiographer



Bowen Wu, Radiographer



Professor Liang Zhu, M.D.