

Intrahepatic Cholangiocarcinoma: Typical Imaging Findings at 0.55T

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Introduction

Cholangiocarcinoma, a malignancy accounting for 15 to 20% of primary liver cancers, can be categorized based on location (intrahepatic, perihilar, or extrahepatic distal) or growth characteristics (mass-forming, periductal-infiltrating, or intraductal). These classifications are crucial due to their diverse clinical presentations and prognosis, which are contingent upon both factors. The cancer is predominantly found in the perihilar region, and less frequently in distal and intrahepatic locations, but the incidence of intrahepatic cases is on the rise [1–4].

Although major liver resection remains the primary treatment approach, eligibility for surgery is limited to only 12 to 40% of patients. After surgery, 5-year survival ranges from 25 to 40%, with tumor recurrence in 50 to 70% of cases. In instances of unresectable cholangiocarcinoma, the prognosis is grim, with survival rates as low as 35.4% at one year and 1.6% at three years. Unresectable criteria for intrahepatic cholangiocarcinoma (ICC) are distant or intrahepatic metastases, invasion or encasement of major vessels, or extensive regional lymph nodes [4, 5].

Magnetic resonance imaging (MRI) has the capability to differentiate the dissemination of tumors along bile ducts, owing to its exceptional soft-tissue contrast. Hence, it is the preferred imaging modality for both diagnosing and staging cholangiocarcinoma. In terms of precision, its efficacy rivals the combined accuracy of contrast-enhanced computed tomography (CE-CT) and direct cholangiography [6].

In recent times, there has been a resurgence in the popularity of low-field MRI systems, driven by improvements in image reconstruction – from parallel imaging and compressed sensing to deep learning image reconstruction. These developments mean clinicians can make optimal use of the available signal while exploiting the physical advantages of low-field MRI, such as reduced artifacts and increased patient comfort [7].

For a comprehensive assessment of cholangiocarcinoma, an ideal protocol should include magnetic resonance cholangiopancreatography (MRCP), conventional T1- and T2-weighted abdominal MRI pulse sequences

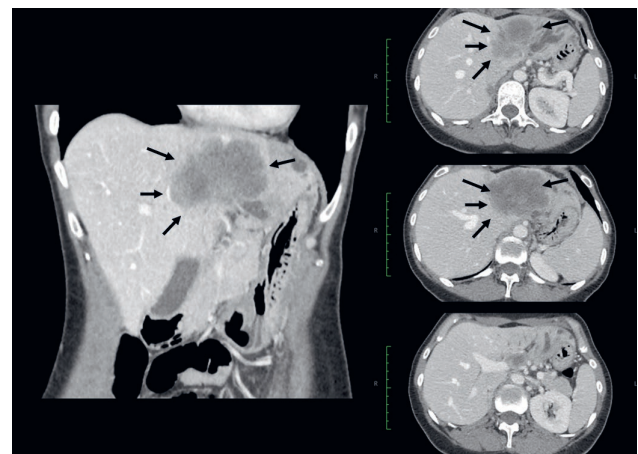
(including T1 in- and out-of-phase imaging), diffusion-weighted imaging (DWI), and multiphase contrast-enhanced sequences acquired during the arterial, portal venous, and delayed phases. Our system, the 0.55T MAGNETOM Free.Max (Siemens Healthcare, Erlangen, Germany), is capable of doing this, as we show in the case report [6].

Case report

We present the case of a 52-year-old woman with an unremarkable medical history, who presented to the emergency department with upper abdominal pain and notable weight loss.

During the physical examination, no indications of jaundice were evident. The laboratory results revealed anemia (hemoglobin 10.9 g/dL) and normal levels of AST, ALT, and total bilirubin.

The initial assessment using contrast-enhanced abdominal and pelvic CT imaging revealed a substantial hypo-attenuating mass situated in the left hepatic lobe, accompanied by distal intrahepatic bile duct dilation within hepatic segments II and III.



1 Abdominal CT showing a large mass (arrows).

Furthermore, a suspicious adenopathy measuring 2.2×1.5 cm was detected in the hilar/periceliac region, along with a right adrenal mass of 1.3 cm exhibiting a density surpassing 10 HU. Notably, no dilation was observed in the remaining intrahepatic bile ducts or the hepatic and common bile ducts.

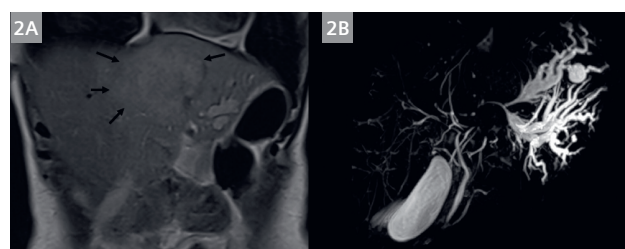
Following the findings from the CE-CT, the patient was referred to undergo MRCP.

Further study with MRCP depicted a large heterogeneous intrahepatic left lobe mass, with low signal intensity on T1-weighted imaging, high signal intensity on T2-weighted imaging, and restricted diffusion on DWI, especially at the periphery of the mass ('target diffusion' on high b-values).

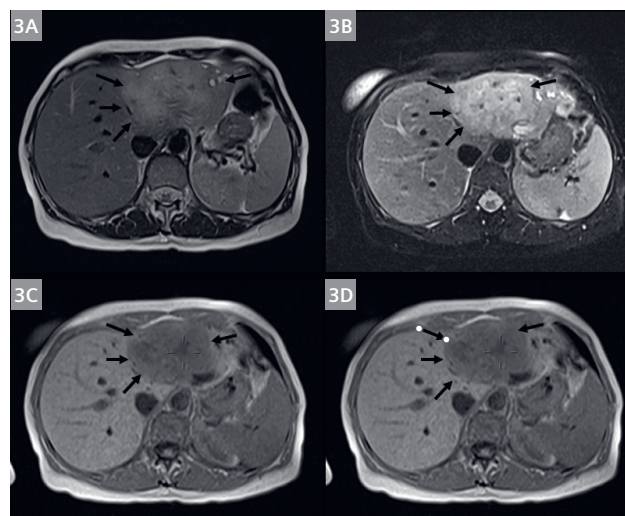
On dynamic contrast-enhanced MRI with extracellular contrast material, the mass also exhibits prominent peripheral rim enhancement with centripetal or gradual progressive enhancement. Central hypoattenuating areas in the mass represent necrosis and fibrosis, which are also responsible for the target diffusion appearance. The mass was also responsible for the dilated intrahepatic biliary ducts at the periphery of the left hepatic lobe.

Sequences/ Parameters	TR (ms)	TE (ms)	TA (s)	Matrix (mm)
Cor T2 TSE	2240	75	75	$0.8 \times 0.8 \times 6$
Tra T2 TSE	2800	75	68	$0.8 \times 0.8 \times 6$
Tra T2 TSE FS	3300	80	75	$0.9 \times 0.9 \times 6$
Tra T1 in/opp phase	213	6.5/13	79	$0.7 \times 0.7 \times 6$
MRCP	2500	702	320	$0.6 \times 0.6 \times 1$
Tra DWI (b50 / b800 s/mm ²)	7800	93	336	$1.5 \times 1.5 \times 6$
Tra T1 VIBE Dixon (pre, arterial, venous, and delayed phase)	9.74	2.71	21	$0.8 \times 0.8 \times 3$

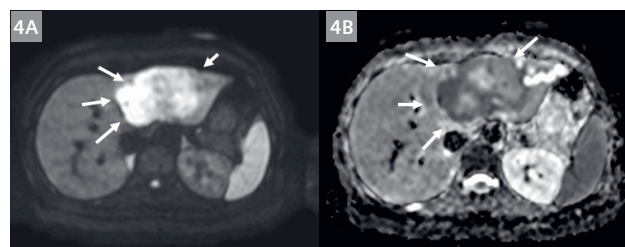
Table 1: Acquisition parameters for the 0.55T MAGNETOM Free.Max.



2 Coronal T2-weighted imaging (**2A**) and 3D MRCP maximum intensity projection (MIP) images (**2B**) showing a large left lobe hepatic mass with peripheral dilation of intrahepatic bile ducts – segments II and III).



3 Axial T2 (**3A**), T2 FS (**3B**), T1 GRE in-phase (**3C**), and GRE out-of-phase images (**3D**).



4 Axial DWI b800 s/mm² (**4A**) and ADC map (**4B**) showing 'target' restricted diffusion, more clearly appreciated on ADC map.



5 Dynamic study after intravenous contrast (**5A** arterial, **5B** venous, and **5C** delay phases) showing gradual enhancement of the mass.

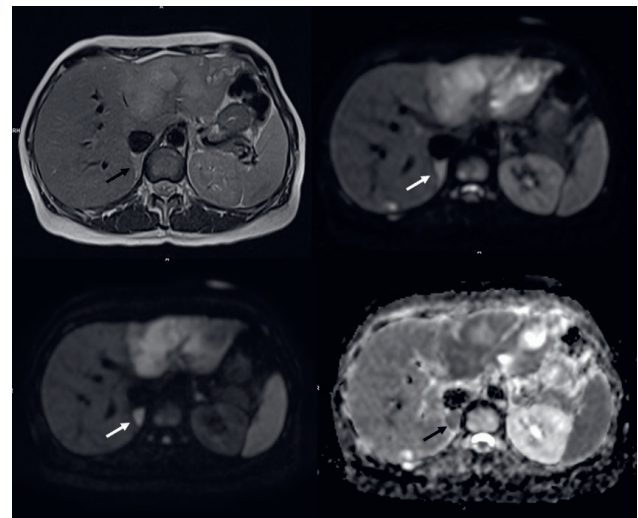
High signal on T2-weighted imaging and restricted diffusion on DWI of the right adrenal mass and of the periceliac/hilar lymph nodes was also indicative of metastatic distant disease.

After multidisciplinary oncology consultation, the patient was diagnosed with unresectable disease and started systemic chemotherapy.

Conclusion

MRCP is considered the imaging modality of choice in the diagnosis of cholangiocarcinoma. This is because of its high contrast resolution, multiplanar capability, and its ability to evaluate biliary, parenchymal, and vascular extensions. Distant disease can also be clearly depicted, with a direct impact on treatment decisions.

Our case report shows the strengths of a 0.55T MR scanner in obtaining high-quality images, allowing the radiologist to perform accurate disease staging with a high level of confidence.



6 Small right adrenal mass showing restricted diffusion and high intensity on T2-weighted imaging, highly suspicious for metastatic disease (arrows).

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