

REVIEW

Biliary malignancies: multi-slice CT or MRI?

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Abstract

Cholangiocarcinoma is the most common malignant bile duct and the second most common primary malignant tumor in the liver. It can be classified as intrahepatic (peripheral) or extrahepatic. Extrahepatic cholangiocarcinoma originate most often from the main hepatic duct and confluence (referred to as Klatskin tumor). The patients usually present with jaundice because of biliary obstruction. Prognosis of hilar cholangiocarcinoma is poor, because most tumors are not resectable at the time of diagnosis. Surgical exploration should only be undertaken when there is potential for curative resection shown by imaging.

ERCP (endoscopic retrograde cholangio-pancreatography) demonstration of Klatskin tumors is often incomplete due to incomplete ductal filling. MR imaging and helical CT are the methods of choice in the diagnosis and staging of hilar cholangiocarcinoma. MR cholangiography, in conjunction with MR imaging and MRA, provides information on tumor size, bile duct involvement, and vascular compromise, and thus resectability of the tumor. Multi-phasic contrast-enhanced thin-section helical CT may show Klatskin tumors with a sensitivity of up to 100%. Tumors are better seen on arterial-dominant phase than on portal venous phase scans (sensitivity, 100% vs. 86%). However, single-slice CT is not accurate for assessing resectability (accuracy, 60%), because proximal tumor extent is largely underestimated. Preliminary experience with multi-slice CT indicates that the extent of bile duct involvement may be better displayed due to multi-planar imaging capabilities. Curved planar reconstruction of multi-slice CT data sets along the portal vein and the bile ducts reveals tumor involvement.

Intrahepatic cholangiocarcinoma have a non-specific imaging appearance. Because of abundant fibrous stroma, they exhibit little contrast enhancement during CT or MR imaging scanning in the early phase with delayed accumulation of contrast material. Although not pathognomonic, the presence of bile duct dilatation within the tumor and retraction of the liver capsule adjacent to the tumor are suggestive of the diagnosis.

In conclusion, the role of contrast-enhanced MR imaging with MR cholangiography and multi-slice CT in the detection and preoperative staging of cholangiocarcinoma is emphasised.

Keywords: Cholangiocarcinoma; Klatskin tumor; multi-slice CT; MR imaging.

Classification of bile duct malignancies

Biliary duct tumors are uncommon, with cholangiocarcinoma being by far the most common. Cholangiocarcinoma arise from any portion of the intrahepatic or extrahepatic bile duct epithelium. Accordingly, they are classified as intrahepatic (peripheral) cholangiocarci-

noma or extrahepatic cholangiocarcinoma. They usually become clinically apparent because of progressive biliary obstruction. Intrahepatic cholangiocarcinoma are the second most common primary malignancy of the liver. Extrahepatic cholangiocarcinoma originate most often from the main hepatic duct and confluence (often referred to as Klatskin tumor). Rarely, extrahepatic

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cholangiocarcinoma originate from the distal common bile duct, and which are then virtually indistinguishable from pancreatic tumors by imaging.

Klatskin tumor

Hilar cholangiocarcinoma (Klatskin tumors) are categorised according to the Bismuth classification^[1]: a type I tumor involves the main hepatic duct below the bifurcation; a type II tumor affects the main hepatic duct bifurcation; a type III tumor involves segmental ducts beyond the primary hepatic duct bifurcation in one liver lobe (type IIIa: right lobe, type IIIb: left lobe); type IV tumors involve segmental ducts in both liver lobes. Prognosis of hilar cholangiocarcinoma is poor, with few of the tumors being resectable at the time of diagnosis. Thus, surgical exploration should only be undertaken when there is potential for curative resection shown by imaging.

Radiologic evaluation

Diagnosis of Klatskin tumors has been a domain of ERCP, which may provide demonstration of bile duct involvement and histologic proof of malignancy. However, ERCP demonstration of bile duct anatomy is often incomplete due to incomplete ductal filling in Klatskin tumors. Sonography is sensitive in detecting biliary obstruction in these patients, although small tumors are often not seen. Contrast-enhanced MR imaging and helical CT have proved useful in the diagnosis and staging of hilar cholangiocarcinoma. HASTE MR cholangiography, in conjunction with contrast-enhanced MR imaging and MRA, allows assessment of tumor size, bile duct involvement, and vascular compromise, which is crucial for assessment of resectability of the tumor^[2] (Fig. 1). Multi-phasic contrast-enhanced thin-section single-slice helical CT may show Klatskin tumors with a sensitivity of up to 100%^[3]. Tumors are better seen on arterial-dominant phase scans than on portal venous phase scans (sensitivity 100% vs. 86%). However, single-slice helical CT is still inaccurate for assessing resectability (accuracy, 60%), because proximal tumor extent is largely underestimated. Preliminary experience with multi-slice CT indicates that tumor extension may be better displayed due to multi-planar imaging capabilities. Curved planar reconstructions along the main, right, and left portal vein and along the intrahepatic bile ducts show the extent of tumor involvement more precisely^[4]. In contrast to 'conventional' axial images, they reveal a 'pseudo-surgical' view of the tumor growth pattern. Arterial and portal vein anatomy as well as vascular anomalies relevant for surgery are reliably depicted by multi-slice CT angiography^[5]. Whether or not 3D reconstructions of multi-slice CT data sets

significantly improve the accuracy of CT in predicting tumor resectability remains to be shown in prospective studies.

Intrahepatic (peripheral) cholangiocarcinoma

Peripheral cholangiocarcinoma is a primary adenocarcinoma of the liver arising from the epithelium of the small bile ducts. Histopathologically, the diagnosis is difficult to differentiate from metastatic adenocarcinoma. Macroscopically, intrahepatic cholangiocarcinoma are classified as mass-forming type, periductal-infiltrating type, and intraductal-growth type^[6]. Intrahepatic cholangiocarcinoma have a non-specific imaging appearance. Because of the presence of abundant fibrous stroma, these tumors most often show little contrast enhancement at CT or MR imaging scanning in the early phase, but delayed accumulation of contrast material. Although non-specific signs, the presence of bile duct dilatation within the tumor and retraction of the liver capsule adjacent to the tumor are suggestive of the diagnosis^[7].

Radiologic evaluation

Only a few studies have compared the diagnostic yield of contrast-enhanced CT and MR imaging in the detection and staging of peripheral cholangiocarcinoma. Choi *et al.* reported in a study on 11 patients that MR imaging was slightly superior to contrast-enhanced dynamic CT in tumor detection^[8]. In a study comparing dynamic CT and dynamic gadolinium-enhanced MR imaging, Zhang *et al.* reported that tumor conspicuity was better in MR imaging than in CT in 14 of 20 patients. However, dynamic CT was better than MR imaging for demonstration of vascular involvement and extrahepatic extension^[9]. To the best of our knowledge, no further studies using state-of-the-art helical or multi-slice CT equipment (Fig. 2) and MR imaging with liver-specific contrast agents have been conducted.

Conclusion

In conclusion, detection and accurate staging of Klatskin tumors is improved by multi-phasic helical CT scanning and MR imaging. Curved planar reconstructions from multi-slice CT data sets with thin collimation may further improve our ability to diagnose vascular involvement. MR cholangiography, in conjunction with contrast-enhanced MR imaging, provides 3D images of the biliary tracts that facilitate planning of surgery or guide palliative drainage.

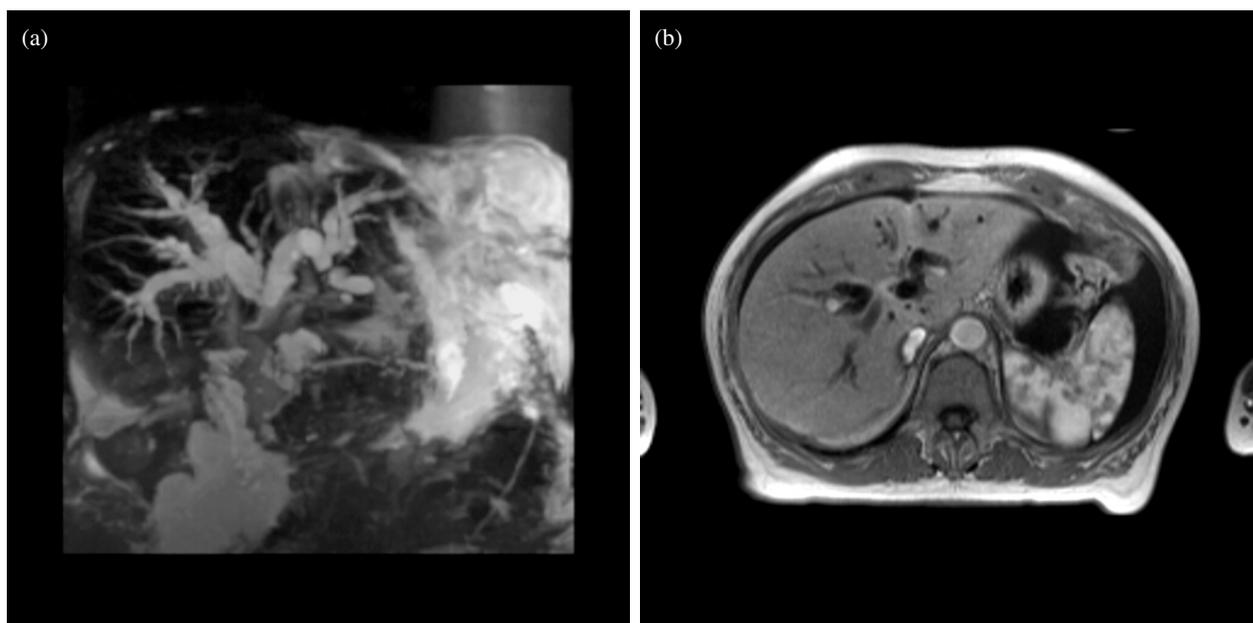


Figure 1 Klatskin tumor. (a) MRCP demonstrates tumor involvement of the hepatic duct bifurcation with massive intrahepatic bile duct dilatation; (b) Gadolinium-enhanced MRI in the early arterial phase reveals a small hyperenhancing tumor around the bile duct bifurcation.

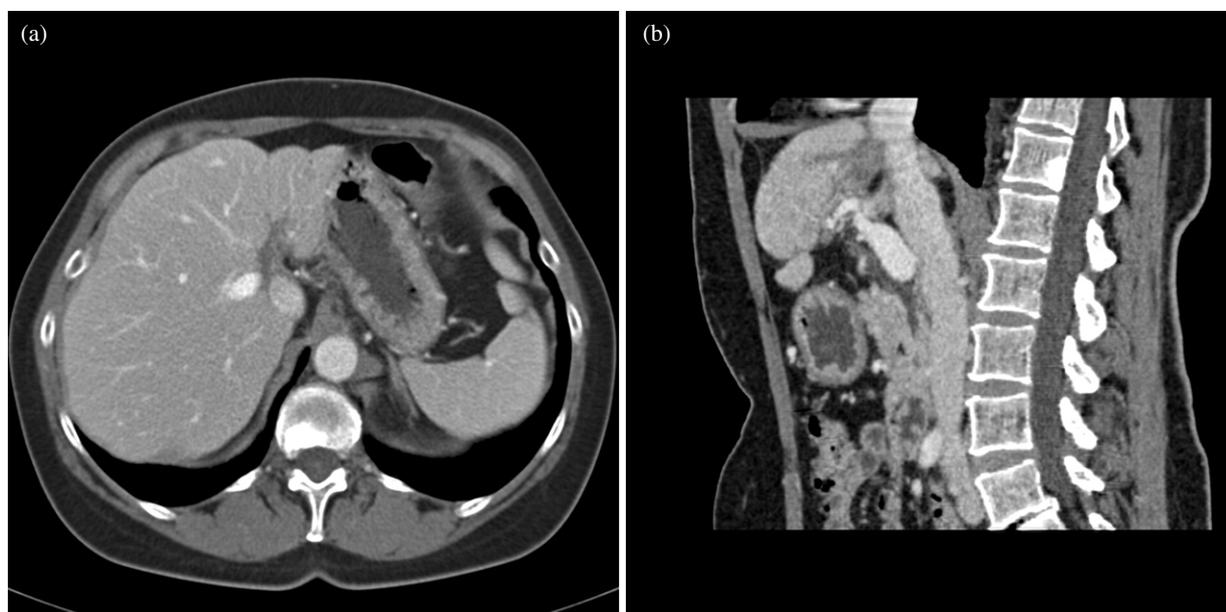


Figure 2 Peripheral cholangiocarcinoma after preoperative chemotherapy. (a) Axial multi-slice CT image shows a small residual mass in the left lobe with thrombosis of the left hepatic vein. (b) The sagittal MPR of the 3D data set demonstrates much better the residual tumor cuff around the thrombosed left hepatic vein, which abuts the inferior vena cava. At surgery, the tumor could be resected along the IVC.

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