PICTORIAL ESSAY

MULTIDETECTOR CT OF HEPATIC ARTERY PATHOLOGIES

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The hepatic artery can be involved by a variety of pathology and diseases. Today MDCT enables high quality imaging of the hepatic artery using axial, MIP and volume rendered images. We illustrate MDCT findings of anatomical variations, aneurysm, dilatation, dissection, arteriovenous fistula, thrombosis and stenosis. Aneurysms can be saccular, fusiform and multiple and may develop due to atherosclerosis, vasculitis, trauma and biopsy. Dilatation of hepatic artery can be seen in portal hypertension, Osler-Weber-Rendu disease and hemangiomatosis. Hepatic artery can be occluded after trauma and transplantation. Dissection develops due to atherosclerosis, Marfan and Ehler Danlos syndromes and during pregnancy. Arteriovenous fistula can be congenital and acquired. We conclude that various hepatic artery pathologies can be confidently diagnosed by MDCT.

Key-words: Aneurysm, hepatic - Hepatic artery, CT – dissection.

Imaging of the visceral vascular structures non-invasively with the development of MDCT is one of the most important forward leaps in radiology in the last decade. With the improvement of the MDCT technology any arterial and venous vascular structure of the abdomen can be easily detected and treatment planning can be done in a straightforward manner. Compared to conventional catheter angiography, MDCT imaging of the vascular tree is sometimes more contributory to the patient’s treatment plan. Pathologies of the hepatic artery are not rare and in some specific situations may be utmost important for the patient’s morbidity and even mortality. In this manuscript, we have tried to provide an overview to pathologies of the hepatic artery in terms of MDCT findings.

Anatomical variations

Exact delineation of the hepatic artery and its branches is a significant factor for the success of liver transplantation, especially for the grafts from living donors. Sufficient arterial flow via the hepatic artery is one of the most important factors for the survival of the graft. MDCT is increasingly being used for the evaluation of the hepatic artery in the pre-transplant phase (1). With the use of the MDCT, other vascular structures related to the liver can also be quickly examined in a single imaging study within a remarkably short period of time. Michel’s classification is the conventional method for the evaluation the vascular variations, and in this system only 55% of the hepatic arteries show the classic branching (1) (Fig. 1). Left hepatic artery arising from the left gastric artery and the replaced right hepatic artery from the superior mesenteric artery are the most common arterial variations (i.e. Michel’s type II and III, respectively) and may be seen in 10% and 11% of the subjects. Hepatic artery originating directly from the abdominal aorta is an uncommon presentation (0.2-3%) but an important finding for the surgeon (2-4) (Fig. 2). Apart from these anatomical variations, a replaced right hepatic artery can give rise to splenic artery (Fig. 3). For pre-transplant imaging, the calibration of the hepatic arteries may also be easily evaluated.

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Fig. 1. — Normal hepatic artery anatomy with volume rendered (VR) images. The common hepatic artery then bifurcates (black arrow) into the gastroduodenal artery (asterisk) and proper hepatic artery. The proper hepatic artery bifurcates into the right and left hepatic arteries (white arrows).

Aneurysm of the hepatic artery

Hepatic artery is the fourth most frequent site of peripheral arterial aneurysms after aorta, iliac artery and splenic artery (5). Among the underlying predisposing factors atherosclerosis, trauma, inflammation and iatrogenic factors may be counted (6). With the increased use of cross-sectional imaging and diagnostic and therapeutic interventions of the liver increased the incidence of the detection of this abnormality (7). Almost 75-80% of the hepatic artery aneurysms are extrahepatic, while intrahepatic aneurysms and pseudoaneurysms are generally related to trauma and biopsy. The aneurysms of the hepatic artery may vary in size and may have a diameter of 14 cm, with a median diameter of 3.6 cm (9) (Fig. 5). The reported indications for treatment of common hepatic artery aneurysms are: symptomatic aneurysms, aneurysms larger than 2 cm, non-atherosclerotic aneurysms and multiple aneurysms (9). Surgery and endovascular intervention are the main treatment modalities. Intrahepatic hepatic artery aneurysms are generally secondary to surgical or percutaneous interventions and the appropriate treatment of this aneurysm must be tailored on individual basis (Fig. 6).

Vasculitis is among the causes of the aneurysms of the hepatic artery. The aneurysms may be seen as diffuse multiple or solitary. Several infectious and inflammatory vasculites including polyarteritis nodosa and systemic lupus erythematosus may cause visceral arterial aneurysms including the hepatic artery (10) (Fig. 7).

Dilatation of the hepatic artery

Dilatation of the hepatic artery may be secondary to several different disorders; however portal hypertension and cirrhosis are the most common causes. Dilatation and spiraling of the hepatic artery (corkscrew appearance) is the classic finding of portal hypertension (Fig. 8).
Osler-Weber-Rendu disease is another rare cause of dilatation of the hepatic artery (Fig. 9). The dilatation of the artery may be extra or intrahepatic and sometimes both (11). Multiple telangiectasias in the liver parenchyma is another interesting finding in this uncommon abnormality.

Diffuse hepatic hemangiomatosis is rare and usually detected in newborns with associated abdominal...
distension and sometimes with congestive heart failure. It is generally associated with skin involvement and isolated forms are rare (1). Hepatic artery can be dilated in a patient with associated hepatic hemangiomatosis (Fig. 10). The underlying etiology for hepatic artery dilatation is most likely the increased arterial circulation of the liver.

Arterioportal fistula

Arterioportal fistula (APF) is a rare cause of portal hypertension. The clinical findings are highly variable ranging from asymptomatic cases to severe findings of portal hypertension, eventually resulting in death. APF may be congenital, post-traumatic and iatrogenic (12). When the rare congenital cases are set aside, most of the patients are traumatic or iatrogenic. Clinical diagnosis is mainly done with imaging. Color Doppler US, CT and MRI may all be used in the diagnosis. Catheter angiography may also be used for detection and treatment. On arterial phase images, enhancement and dilatation of the portal vein and multiple ectatic vascular structures are the main findings (Fig. 11). Increased blood flow to the portal system is most likely the cause of the hyperkinetic portal hypertension (12). Endovascular treatment is the main treatment modality for these patients with highly successful results.

Hepatic artery thrombosis or stenosis

The rate of hepatic artery complications after liver transplant ranges between 5-20% are among the most problematic problems in the early phase of the post-transplant period (13, 14). The hepatic artery thrombosis or stenosis are the predominant disorders affecting the hepatic artery in the posttransplant period. Hepatic artery thrombosis is a potentially complicating pathology that may end up with liver failure (75-88%) and death may ensue in 57% of these patients (15).

The hepatic artery is very significant for the liver parenchyma and bile duct system, particularly in the early post-operative period. Early detection of this abnormality is of
paramount importance for prompt intervention and potential salvage of the graft. Generally color Doppler US is the first imaging modality in the early phase with its great versatility that allows bedside evaluation. In the past, catheter angiography was the main evaluation method for hepatic artery; currently CT and MR angiography are preferred for diagnosis. CT angiography is highly useful compared to MRI with its quick application and highly accurate results. MRI also demands strong patient cooperation for accurate imaging which may be hard to obtain in a patient in early post-operative period.

Classical imaging finding in CT angiography is the absence of contrast filling in the presumed trajectory of the hepatic artery right anterior to portal vein in the hepatic hilum (Fig. 12). With isotropic multiple reformatted images the exact location of the stenosis or thrombosis may be detected and useful guidance for endovascular or surgical intervention may be supplied. Additionally other vascular or visceral organ abnormalities that may mimic arterial complications may also be easily detected.

Hepatic artery dissection

Dissection of the abdominal visceral arteries are rare clinical occurrence and may be iatrogenic or due to continuation of the abdominal aortic aneurysm (16) (Fig. 13). Arterial dissection is essentially the separation of two layers of the arterial wall secondary to intramural hematoma (17). Patients may be asymptomatic or may present with signs of ischemia of the affected vascular territory. Dissection of the hepatic artery is rare and may present with jaundice (16). Apart from the iatrogenic dissections several underlying diseases may cause the dissection of visceral artery aneurysms like, atherosclerosis, collagen vascular disorders, Marfan syndrome, Ehler Danlos syndrome, pregnancy and syphilis (18). MDCT angiography appears to be the most useful modality for this diagnosis.

Conclusion

MDCT angiography is a very robust and versatile imaging modality which allows highly accurate and prompt information about the pathologies of the hepatic artery. With the ability of imaging the trajectory of hepatic artery in almost every plane with isotropic data, it is relatively straightforward for the radiologists to recognize these abnormalities and inform the referring clinician in a very time efficient manner. Obtaining both arterial and venous phase images may increase the diagnostic accuracy of MDCT, allowing both the evaluation of the hepatic vasculature and the other abdominal mimickers. In this article, we summarized the role of MDCT in a variety of clinical disorders of the hepatic artery and increased the acquaintance of the practicing radiologists.

References