

Cystic lesions of the liver

Poster No.: C-0408
Congress: ECR 2014
Type: Educational Exhibit
Authors: E. Rosado¹, J. Pereira², S. El Bouchaibi³, M. A. A. Bali⁴;
¹Amadora/PT, ²Lisboa/PT, ³Bruxelles/BE, ⁴Brussels/BE
Keywords: Abdomen, Liver, MR, CT, Ultrasound, Diagnostic procedure, Cysts, Abscess, Neoplasia
DOI: 10.1594/ecr2014/C-0408

Any information contained in this pdf file is automatically generated from digital material submitted to EPOS 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 ECR's endorsement, sponsorship or recommendation of the third party, information, product or service. ECR 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 ECR 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.myESR.org

Learning objectives

To present CT and MR findings of cystic lesions of the liver and to highlight the most relevant differential features.

Background

Cystic liver lesions are commonly encountered findings on radiologic examinations and may represent a broad spectrum of entities ranging from benign developmental cysts to malignant neoplasms. Cystic lesions may be classified as developmental, neoplastic, inflammatory or miscellaneous.

Important features to be assessed are location, size, unifocal or multifocal appearance, evaluation of cyst morphological complexity as wall thickness, presence or absence of septa, calcifications, internal nodules and the enhancing patterns. These features allow cystic lesion classification as probably benign or malignant and, in most cases, a specific diagnosis can be suggested. The imaging characteristics should be correlated with relevant clinical and biological parameters, which include sex, age, epidemiology and clinical history.

As radiologic features of various cystic liver lesions frequently overlap, a histologic diagnosis is often required. Fine needle aspiration biopsy under image guidance is the preferred diagnostic method. It can be performed percutaneously or endoscopically providing adequate tissue samples.

Because clinical implications and therapeutic strategies vary enormously according to the etiology of each lesion, all efforts should be done to achieve a specific diagnosis.

Findings and procedure details

1. Benign lesions

1.1 Hepatic cysts

Hepatic cysts are benign, congenital lesions derived from biliary endothelium that do not communicate with the biliary tree. They are usually multiple, asymptomatic and more frequent in women.

On CT, hepatic cysts are round, well-defined, homogeneous lesions of water-density, without contrast enhancement (Fig. 1). On MR hepatic cysts are homogeneously hypointense on T1-weighted images and hyperintense on T2-weighted images (Fig. 2). They characteristically increase in signal intensity on heavily T2-weighted imaging. This behavior helps to differentiate simple hepatic cysts from malignant cystic lesions, which appear less intense on these sequences.

1.2 Polycystic liver disease

Although hepatic polycystic disease is seen in 40% of cases of autosomal-dominant polycystic kidney disease, it may also occur in the absence of renal involvement.

Patients have numerous hepatic cysts of various sizes. Imaging characteristics of each cyst are similar to those described for simple hepatic cysts: well circumscribed round lesions that are hypodense on CT, hypointense on T1-weighted images and hyperintense on T2-weighted images, without contrast enhancement (Fig. 3 a). When large and numerous, cysts may look somewhat compressed, with polygonal borders (Fig. 3 b).

Cyst complications, such as internal hemorrhage, are more common due to the greater number of lesions.

1.3 Bile duct hamartomas

Bile duct hamartomas, also known as von Meyenburg complexes, originate from embryonic bile ducts that fail to involute. They are rare, benign and asymptomatic malformations of the biliary tract.

On CT, biliary hamartomas appear as multiple hypodense lesions, typically measuring less than 1.5 cm in diameter. Their margins are more irregular than simple hepatic cysts. On MR biliary hamartomas are hypointense on T1-weighted images and hyperintense on T2-weighted images (Fig. 4 a). On heavily T2-weighted images, the signal intensity increases further, almost reaching the signal intensity of fluid. MRCP shows multiple, small, cystic lesions that do not communicate with the biliary tree (Fig. 4 b).

1.4 Caroli disease

Caroli disease is an autosomal-recessive disorder characterized by multifocal saccular dilation of the intrahepatic bile ducts. It is often associated with polycystic kidney disease, medullary sponge kidney and medullary cystic disease. Two main types have been described: type 1, the rarer pure form, is associated with intrahepatic stone formation and cholangitis. The more common form of the disease (type 2) is associated with other ductal

plate abnormalities such as periportal fibrosis and may progress to portal hypertension and cirrhosis. Distribution of the intrahepatic duct dilatation may be segmental (83%) or diffuse (17%). The shape of the dilatation is saccular in 76% and fusiform in 24% of the cases.

The characteristic CT appearance is multiple cystic structures of varying size that communicate with the biliary tree. At MR, the dilated and cystic biliary system appears hypointense on T1-weighted images (Fig. 5) and hyperintense on T2-weighted images (Fig. 6). The *central dot sign* may be seen either on CT or MR and it corresponds to intraluminal portal vein radicals within the dilated biliary ducts (Fig. 7). This finding is highly suggestive of Caroli disease. ERCP and MRCP are also helpful to confirm communication between the cystic structures and the biliary tree (Fig. 8).

1.5 Cavernous hemangioma

Giant hemangiomas may outgrow their blood supply and show central cystic degeneration. The cystic component appears hypodense on CT examinations. On MR, it has areas of high signal intensity on T2-weighted images and cleftlike areas of low signal intensity on T1-weighted images. The presence of a fluid-fluid level within a cavernous hemangioma is not uncommon. On contrast-enhanced CT and MR the characteristic peripheral nodular enhancement pattern is usually present.

1.6 Abscess

Hepatic abscess are localized collections of pus with associated destruction of the surrounding hepatic parenchyma. Hepatic abscesses may be classified as pyogenic, amebic, or fungal.

On CT, abscesses appear as well-defined hypodense masses. The presence of air is almost pathognomonic. After contrast administration, peripheral enhancement and central hypoenhancing areas are characteristic (Fig 9). On MR, they appear as thick-walled lesions with homogeneous low signal intensity on T1-weighted images and central high signal intensity on T2-weighted images (Fig. 10). High-signal-intensity edema may be seen around the lesion on T2-weighted images (Fig. 11). There is peripheral rim enhancement corresponding to abscess wall after contrast agent administration.

1.7 Hydatid cysts

Hydatid disease is caused by the larval stage of the tapeworm *Echinococcus granulosus*. After eating contaminated food the larvae invade the intestinal wall and reach the liver, where they develop into hepatic hydatid cysts. Each hydatid cyst consists of an

outer pericyst, which corresponds to compressed and fibrotic host liver tissue; an inner endocyst, which is the germinal layer; and a middle laminated membrane or ectocyst. Daughter cysts develop as a result of germinal layer invagination.

On CT, hydatid cysts appear as large, complex cysts, which may be unilocular or multilocular.

They usually have a distinguishable wall and half of them have coarse mural calcifications (Fig. 12). The inner structure may reflect the presence of daughter cysts, as round peripheral structures that may have lower attenuation than fluid within the mother cyst. In later stages the presence of detached membranes is characteristic (Fig. 13). There is little or no contrast enhancement (Fig. 13b).

MR imaging can demonstrate the pericyst as a hypointense rim on both T1 and T2-weighted images and the matrix or hydatid sand which appears hypointense on T1-weighted images and markedly hyperintense on T2-weighted images (Fig. 14). The daughter cysts, when present, are hypointense relative to the matrix on both T1- and T2-weighted images. The cyst doesn't enhance after contrast agent administration (Fig. 14c).

1.8 Intrahepatic extrapancreatic pseudocysts

Hepatic extrapancreatic pseudocysts are rare and occur predominantly in the left lobe of the liver as a result of extension of fluid from the lesser sac into the hepatogastric ligament.

At CT, chronic or subacute pseudocysts appear as well-defined homogeneous subcapsular hypodense masses surrounded by a thin fibrous capsule. More acute pseudocysts may have hyperdense content, due to hemorrhage and necrotic debris. At MR, these well-circumscribed lesions have low signal intensity on T1-weighted images, high signal intensity on T2-weighted images. In the chronic phase, an enhancing capsule is usually visible after contrast agent administration, both on CT and MR. The presence of other imaging findings consistent with pancreatitis may lead to the diagnosis.

1.9 Hematoma

Intrahepatic hematomas usually develop secondary to surgery or trauma. Hemorrhage within a solid liver neoplasm, especially adenomas, is another frequent cause.

At CT, hepatic hematomas are fluid collections with a high attenuation values in the acute or subacute phases. In chronic phases, attenuation values decrease and become identical to those of pure fluid. The signal intensity on MR varies, depending on the methemoglobin content of the lesion, due to its paramagnetic effect.

1.10 Biloma

A biloma is an encapsulated collection of bile outside the biliary tree. It can form spontaneously, secondary to trauma or as an iatrogenic complication after an interventional procedure or surgery. Leakage of bile within the liver parenchyma induces an intense inflammatory response, which may result in the formation of a pseudocapsule.

At CT and MR, a biloma appears as a well-defined or slightly irregular cystic lesion without septa or calcifications. The pseudocapsule is not usually identifiable in the early phase. The filling of the collection after administration of hepatobiliary contrast agent confirms the diagnosis.

1.11 Peribiliary cysts in cirrhosis

Peribiliary cysts are typically found in patients with long standing cirrhosis. They develop around the intrahepatic portal venous branches. These lesions may have variable size and morphology: linear and confluent "tube-like" aspect coursing adjacent to right or left portal vein, or linear cluster of cysts, also called "string of beads" appearance, usually involving predominantly the left lobe. The cysts represent dilatations of the extramural glands in the periductal connective tissue, and may increase in size and number as cirrhosis progresses. Peribiliary cysts have the same imaging appearance as simple cysts: low attenuation at CT, low signal intensity on T1-weighted MR images and high signal intensity on T2-weighted MR images (Fig. 15), with no contrast enhancement (Fig.16).

2. Malignant lesions

2.1 Biliary cystadenoma and cystadenocarcinoma

Biliary cystadenoma and biliary cystadenocarcinoma are premalignant and malignant cystic biliary ductal neoplasms, respectively. They arise mainly from the intrahepatic ducts and are most frequently found within the right lobe of the liver.

The characteristic CT appearance is a solitary complex cystic mass with a well-defined thick

fibrous capsule, internal septa, and mural nodules that show contrast enhancement. Polypoid pedunculated excrescences are seen more commonly in biliary cystadenoma, although papillary areas and polypoid projections have been reported in cystadenomas

without frank malignancy. At MR, an uncomplicated biliary cystadenoma appears as a multilocular cystic mass, with homogeneous low signal intensity on T1-weighted images and homogeneous high signal intensity on T2-weighted images (Fig. 17). However, fluid signal intensity may vary depending on the presence of solid components, hemorrhage, and protein content (Fig.18). After contrast agent administration the capsule, septa and mural nodules show enhancement (Fig.19). As imaging characteristics cannot definitely distinguish biliary cystadenoma from biliary cystadenocarcinoma, the optimal management of these masses is surgical resection.

2.2 Cystic hepatocellular carcinoma

Cystic subtypes of hepatocellular carcinoma (HCC) are rare and are usually related to internal necrosis and cystic degeneration in rapidly growing tumors. In the majority of patients with cystic HCC, CT and MRI show signs of underlying liver cirrhosis and typical characteristics of HCC, such as hypervascularity of solid components and tumor invasion of the portal and hepatic veins. The presence of these signs, even in cases in which the predominant component of the tumor is cystic, may suggest the diagnosis.

2.3 Undifferentiated embryonal sarcoma

Embryonal sarcoma is a rare malignant tumor that occurs predominantly in older children and adolescents but can occur in young adults as well. Although the lesion is predominantly solid on gross pathologic examination, imaging methods usually show a cystic appearance, due to the high water content of the myxoid stroma, which is typical of embryonal sarcoma. At CT, the lesion is hypodense and at MR large portions of the mass are hyperintense on T2-weighted images and hypointense on T1-weighted images. After contrast agent administration there is heterogeneous enhancement of the solid components, which are usually peripherally located.

2.4 Cystic metastasis

Hepatic metastases may appear cystic either due to necrosis and cystic degeneration of rapidly growing hypervascular tumors or as a manifestation of mucinous colonic or ovarian adenocarcinomas. CT and MR usually demonstrate cystic metastases as multiple cystic lesions with complex features, such as thick, irregular, enhancing walls, thick or nodular septa, mural nodularity and internal debris.

A clinical history of a known primary malignancy, particularly in the setting of multifocal lesions, may help to suggest the diagnosis of cystic hepatic metastases, which can be confirmed with imaging-guided biopsy.

Images for this section:

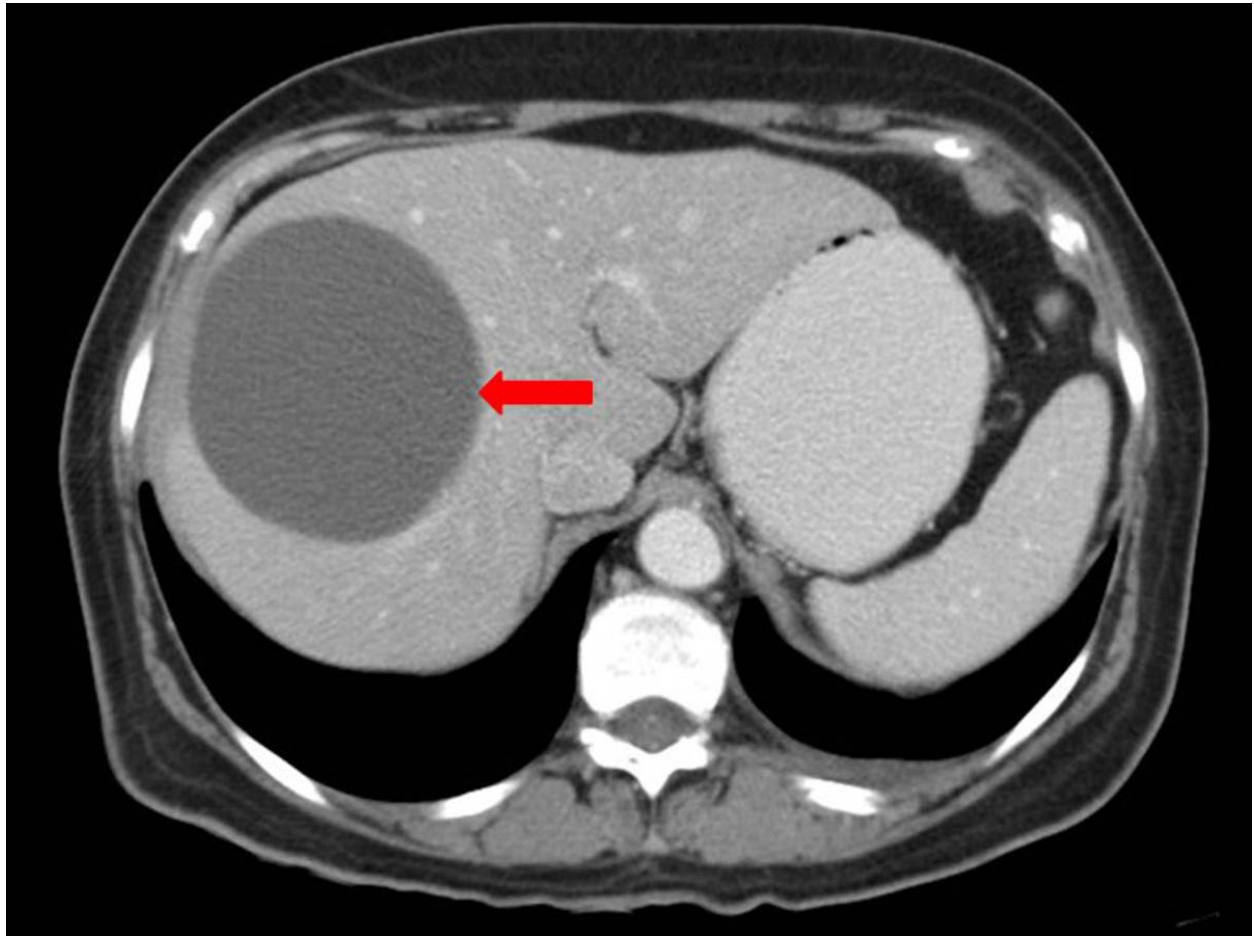


Fig. 1: Contrast enhanced abdominal CT showing a simple hepatic cyst (arrow).

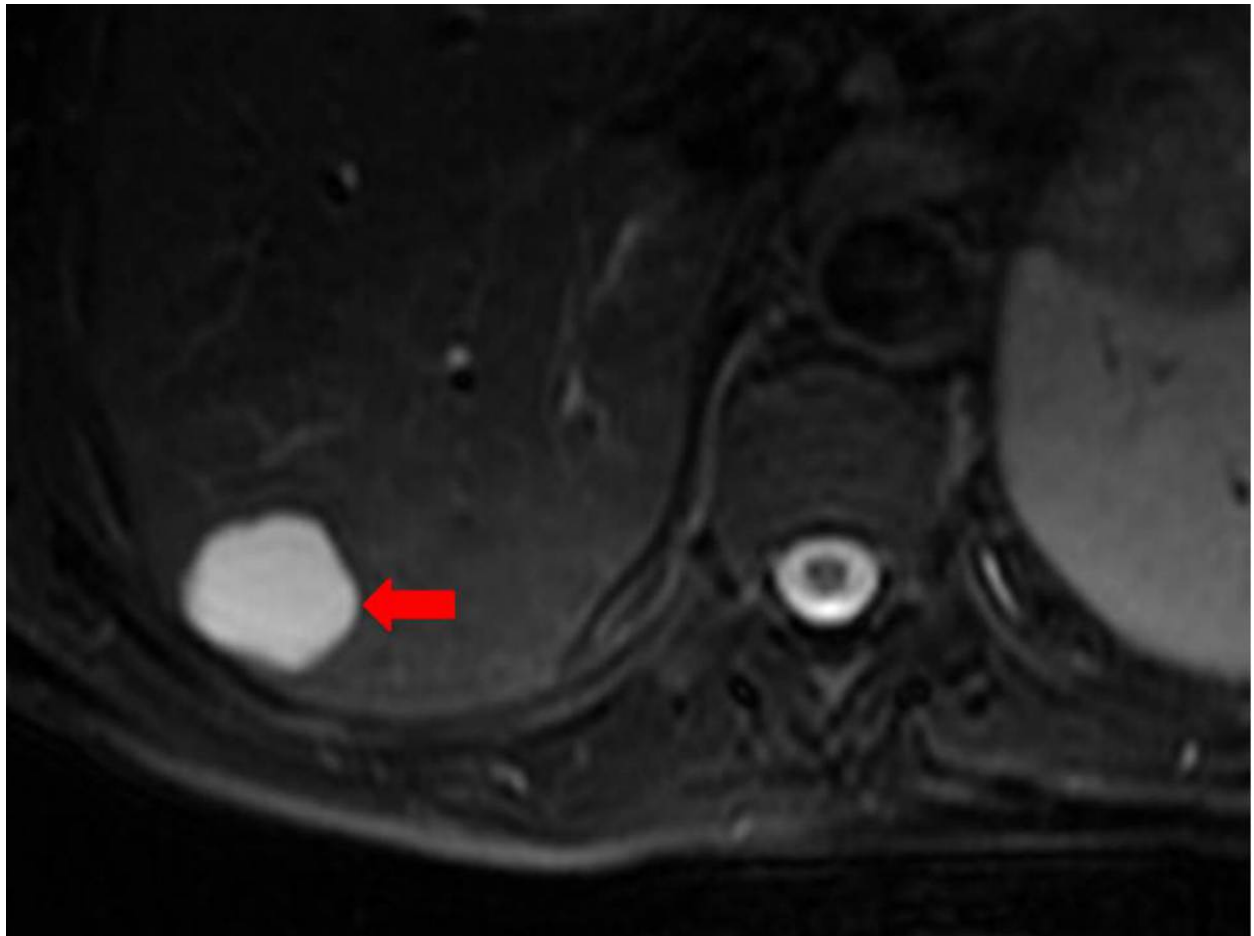


Fig. 2: Axial T2-weighted MR image showing a simple hepatic cyst (arrow).

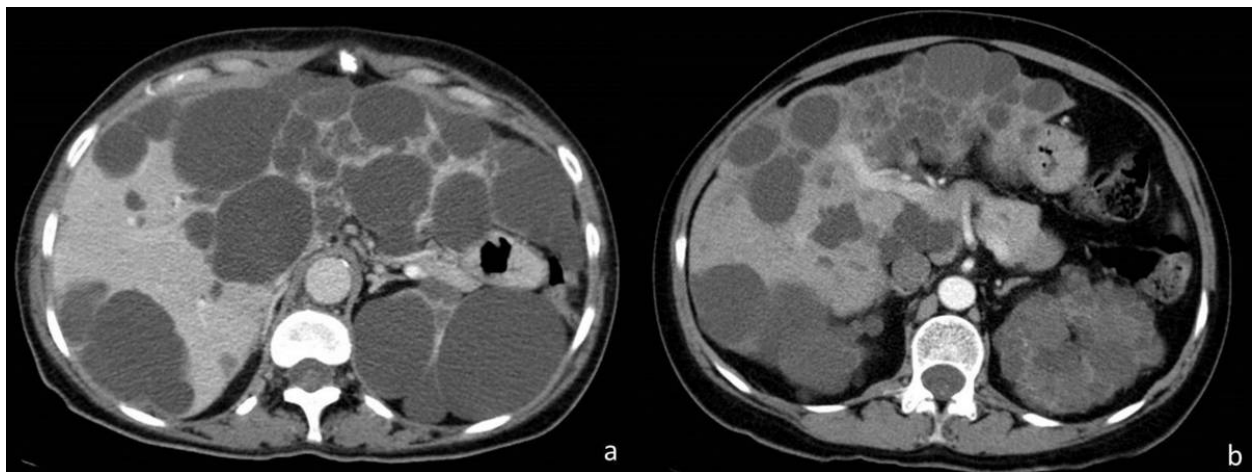


Fig. 3: Contrast enhanced abdominal CT of a patient with polycystic liver disease, showing multiple simple cystic lesions in the liver and kidneys. Image b shows numerous cysts in the left lobe of the liver, some of them with polygonal borders.

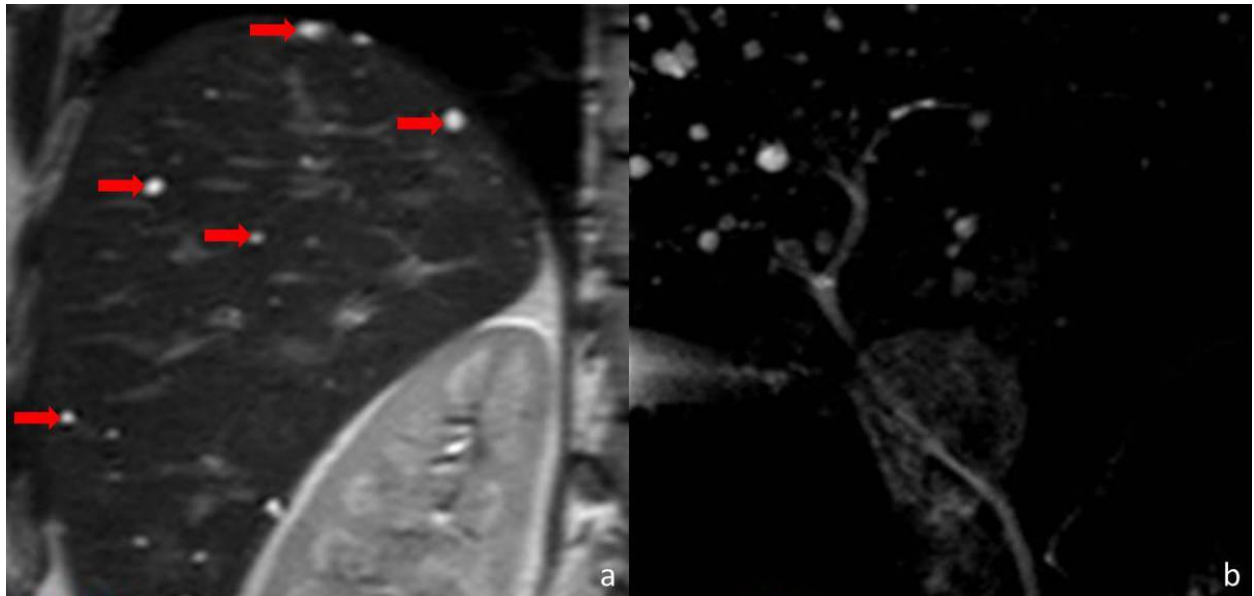


Fig. 4: (a) Coronal T2-weighted MR image; (b) MRCP coronal projection, showing bile duct hamartomas in the liver of a young healthy woman.



Fig. 5: Axial unenhanced T1-weighted MR image of a patient with Caroli disease, showing multiple hypointense cystic structures (arrows), corresponding to saccular dilatations of the biliary tree.



Fig. 6: Axial T2-weighted MR image showing multiple hyperintense cystic lesions (arrows), corresponding to intrahepatic bile duct dilatations in a patient with Caroli disease.

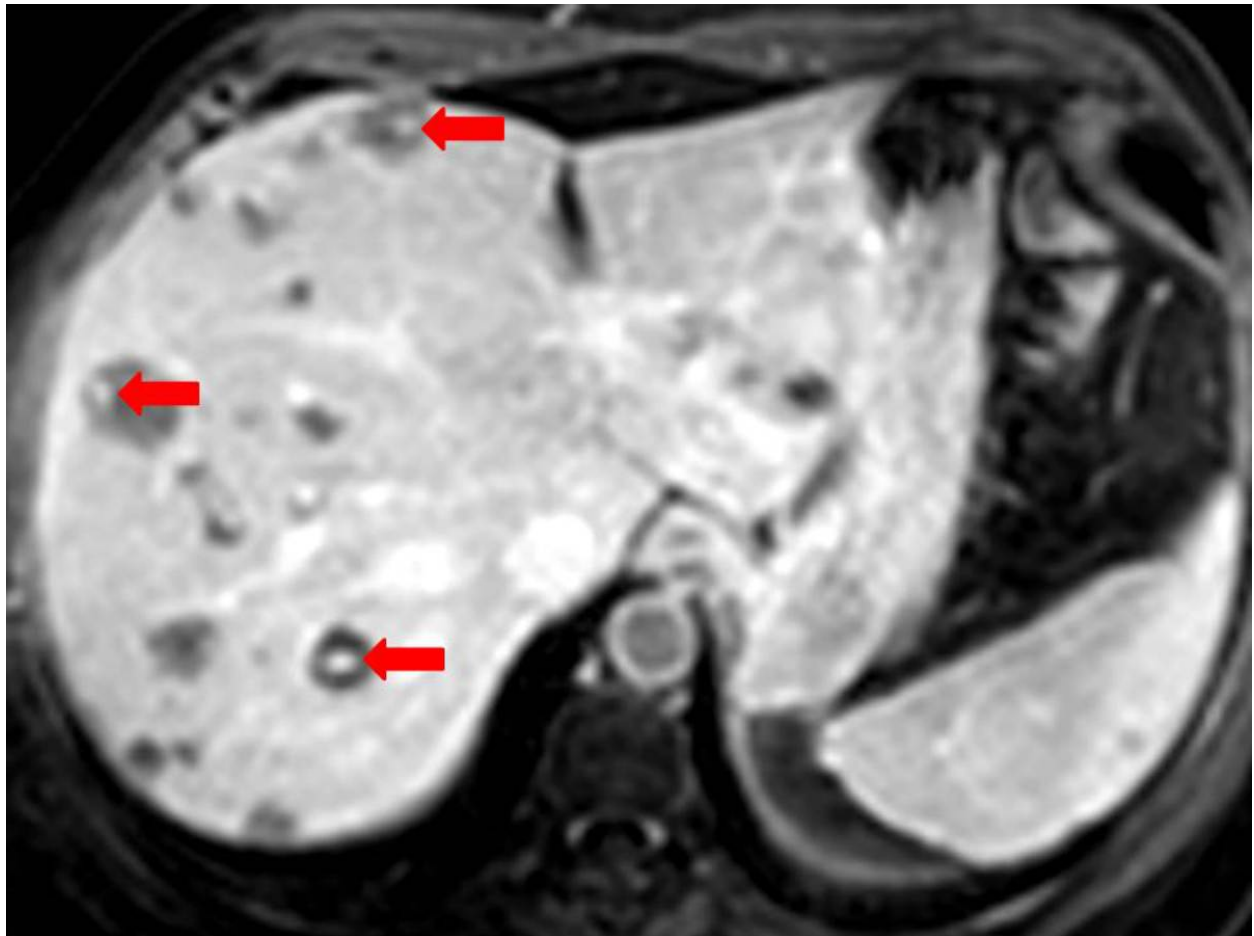


Fig. 7: Central dot sign. Axial contrast-enhanced T1-weighted MR image showing multiple hypoechoic cystic lesions in the liver with a central dot of strong enhancement (arrows).

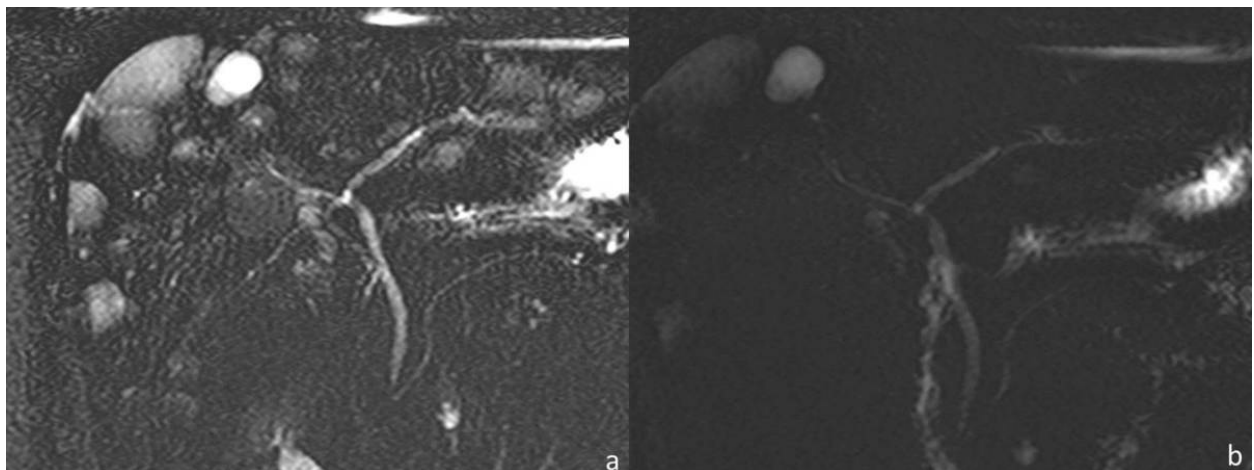


Fig. 8: MRCP coronal projections showing multiple cystic lesions in the liver (a). After hepatic-specific contrast agent administration (b), the cystic lesions disappeared due

to their filling with the T2-negative contrast agent excreted into the bile ducts, proving communication with the biliary tree. A simple cyst remained visible in segment VIII.

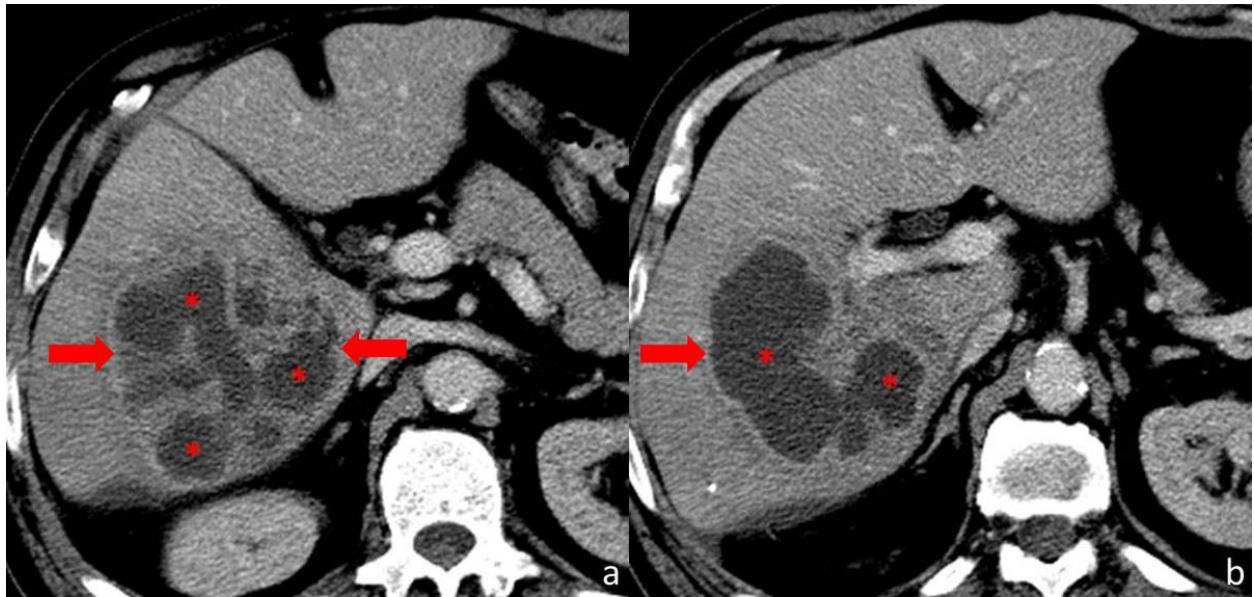


Fig. 9: Contrast-enhanced abdominal CT showing a pyogenic abscess in the right lobe of the liver, with a peripheral hyperenhancing wall (arrows) and multiple, central, hypoenhancing cystic areas (*).

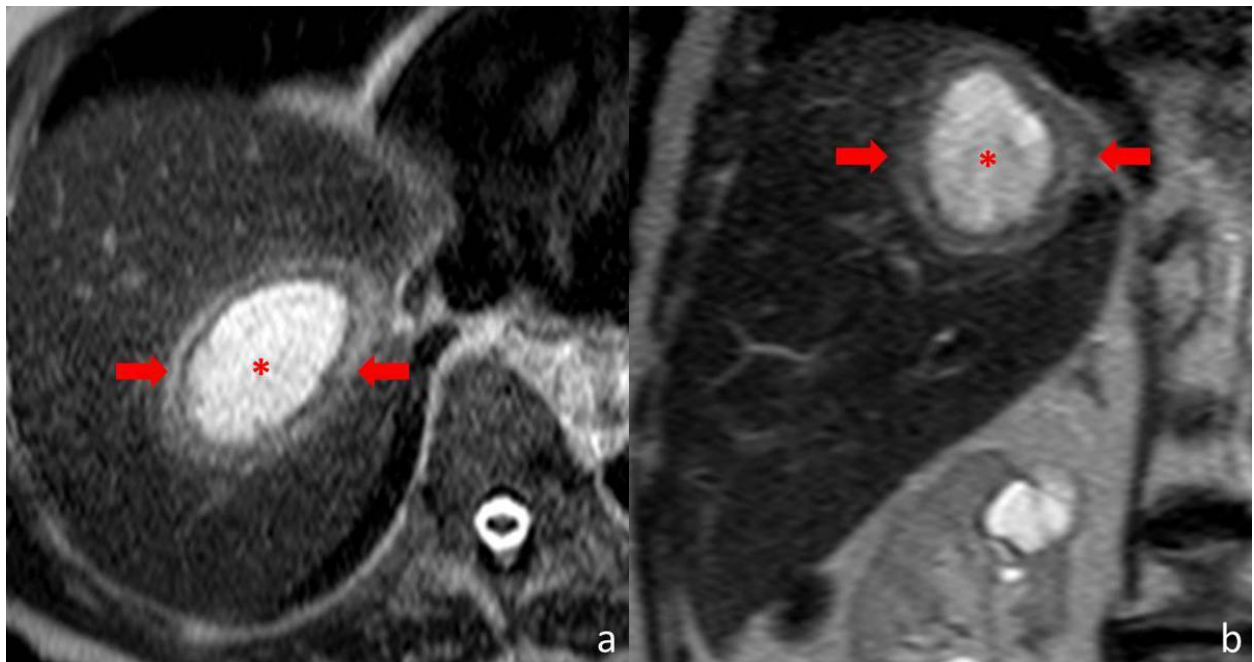


Fig. 10: (a) Axial and (b) coronal T2-weighted MR images showing a well-defined abscess (arrows) with central area of high signal intensity (*).



Fig. 11: Axial T2-weighted MR image of an hepatic abscess with a central cystic area (*) surrounded by a thin wall and a larger area of high signal intensity due to edema.

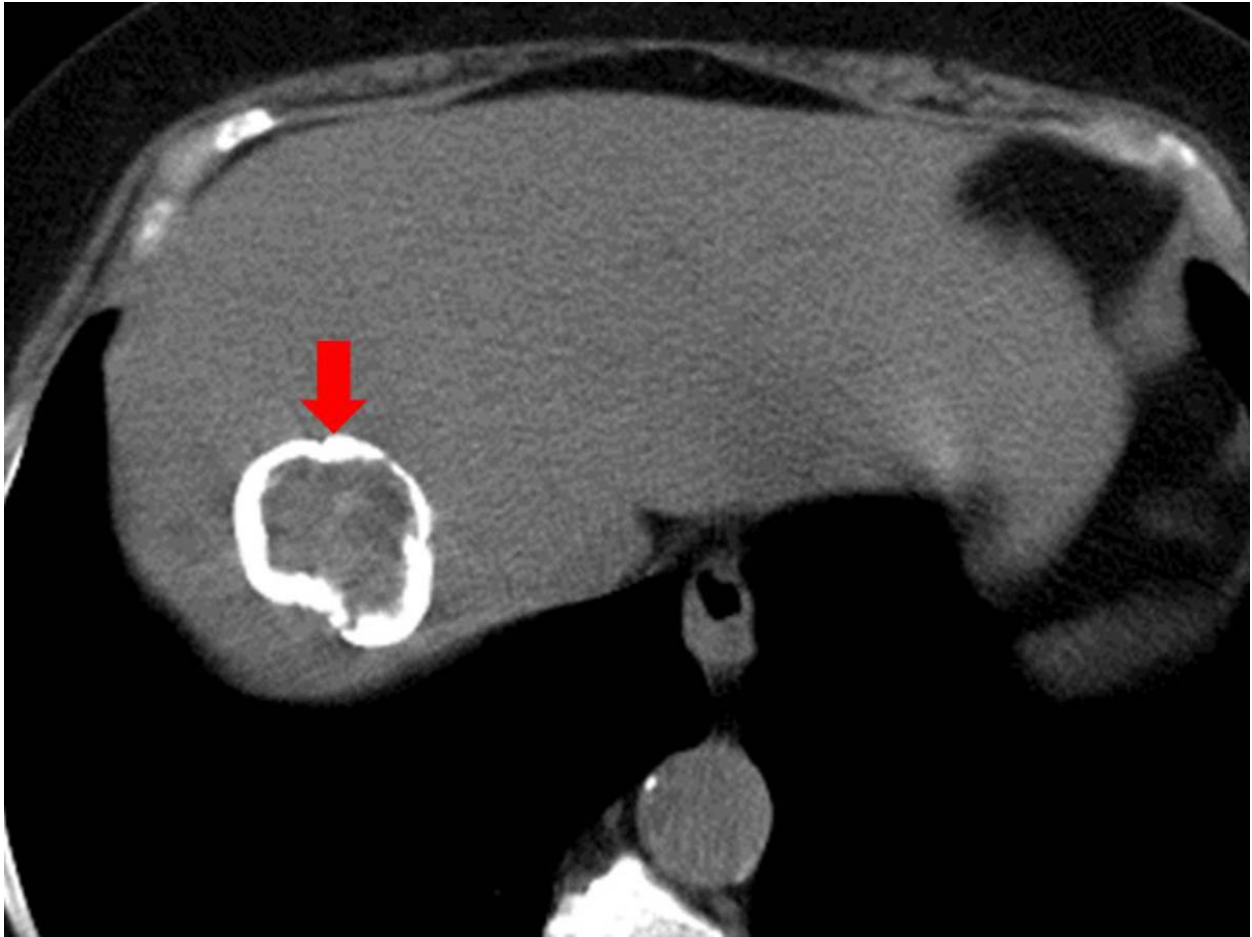


Fig. 12: Unenhanced abdominal CT showing a peripherally calcified hydatid cyst (arrow) in the right lobe of the liver.

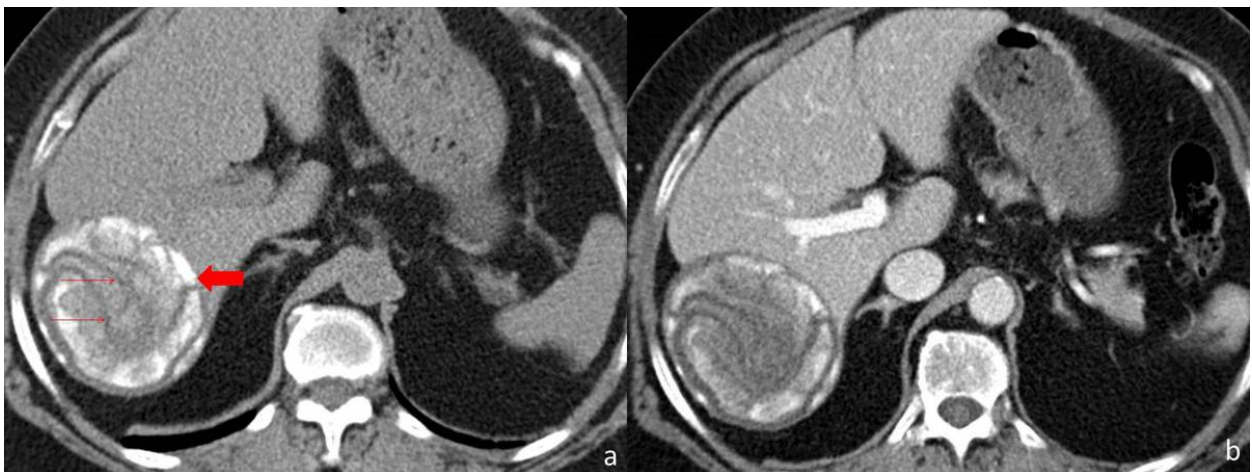


Fig. 13: (a) Unenhanced abdominal CT showing a large hydatid cyst in the right lobe of the liver, with coarse peripheral calcifications (thick arrow) and central detached membranes (thin arrows). (b) Contrast enhanced abdominal CT showing no enhancement of the cyst.

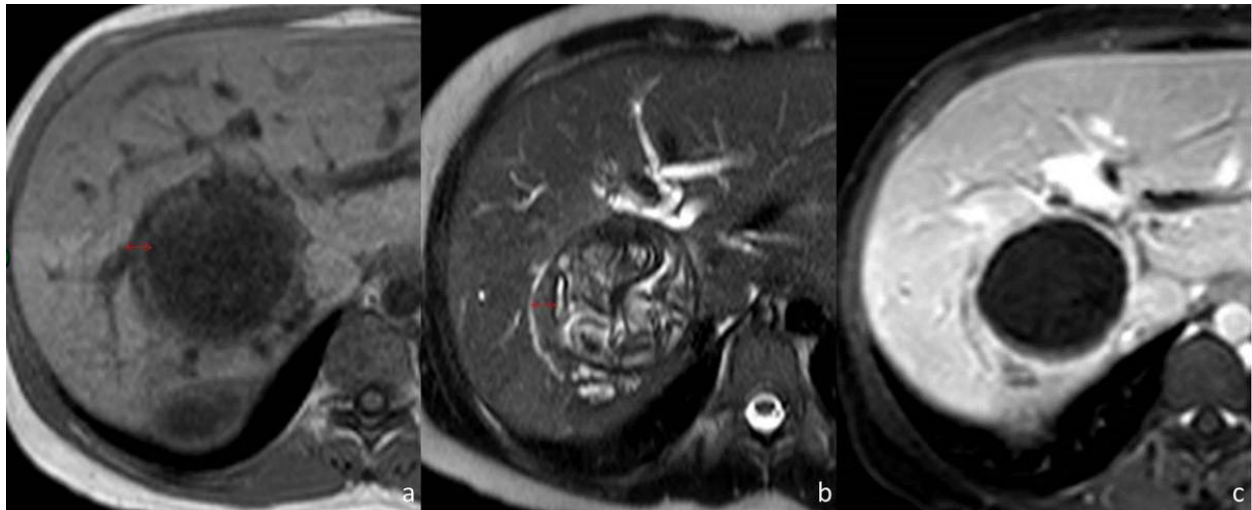


Fig. 14: (a)-Axial unenhanced T1-weighted, (b) axial T2-weighted, (c)-axial contrast-enhanced T1-weighted MR images showing a large hydatid cyst in the right lobe of the liver. The pericyst (double arrow) is hypointense on both T1 and T2-weighted images. The centre of the lesion is homogeneously hypointense on T1-weighted image and heterogeneously hyperintense on T2-weighted image. After contrast agent administration there is no contrast enhancement.

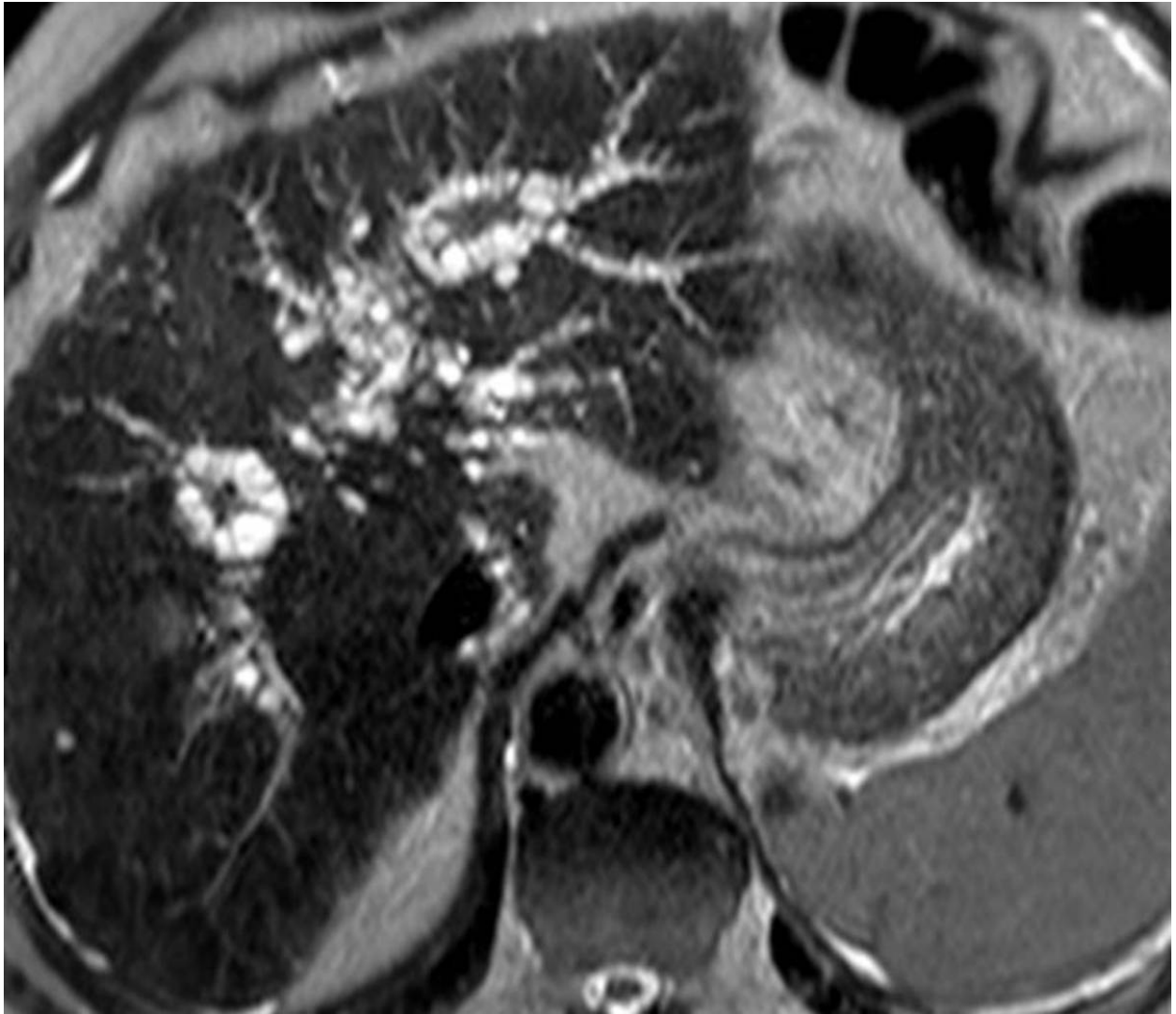


Fig. 15: Axial T2-weighted MR image of a patient with advanced cirrhosis, showing numerous tiny cysts involving the portal triad branches.

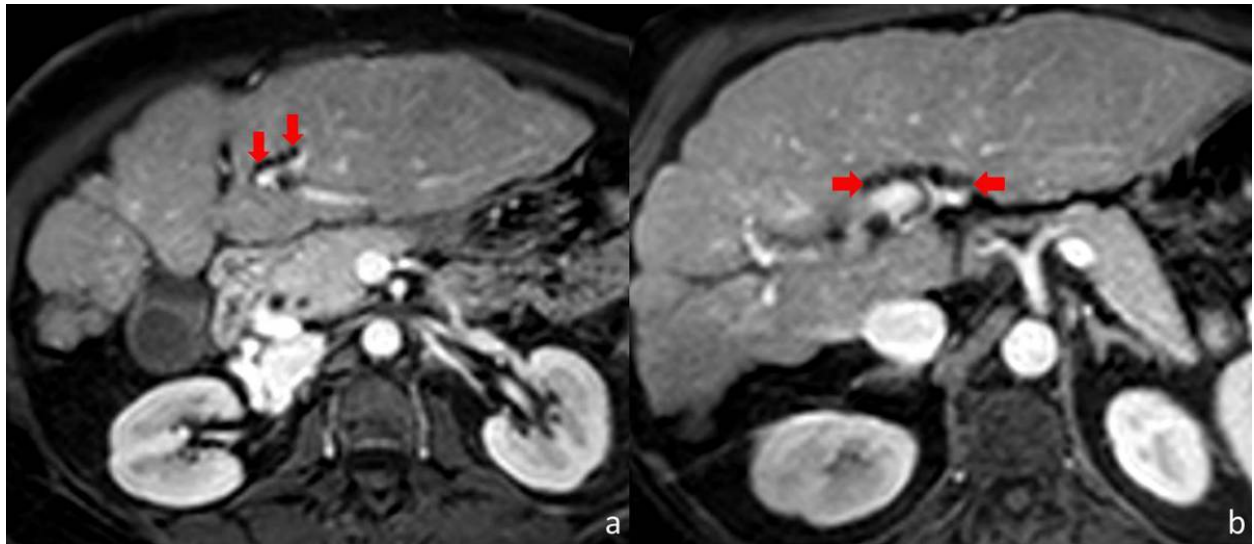


Fig. 16: Axial contrast-enhanced T1-weighted MR images in a patient with advanced cirrhosis show some peribiliary cysts with no contrast enhancement (arrows).

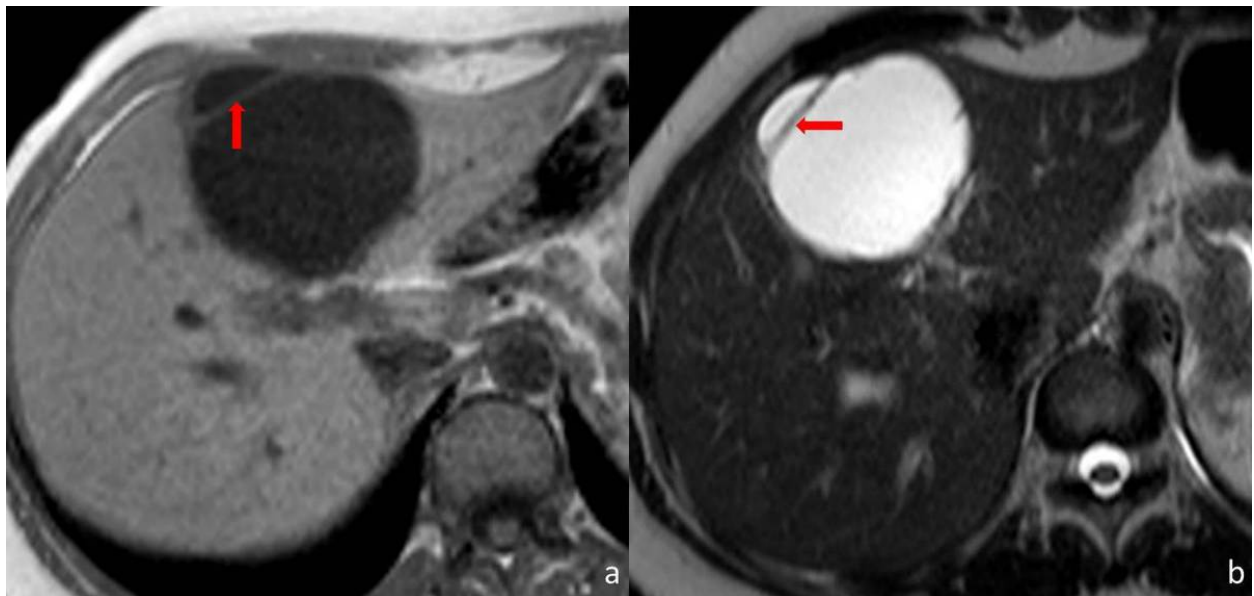


Fig. 17: Abdominal MR showing a histologically proven biliary cystadenoma. (a) on axial unenhanced T1-weighted image, the lesion shows homogeneous low signal intensity. (b) on axial T2-weighted image the lesion shows homogeneous high signal intensity. On both images a thin septum is seen (arrow) with the same signal intensity of the capsule.

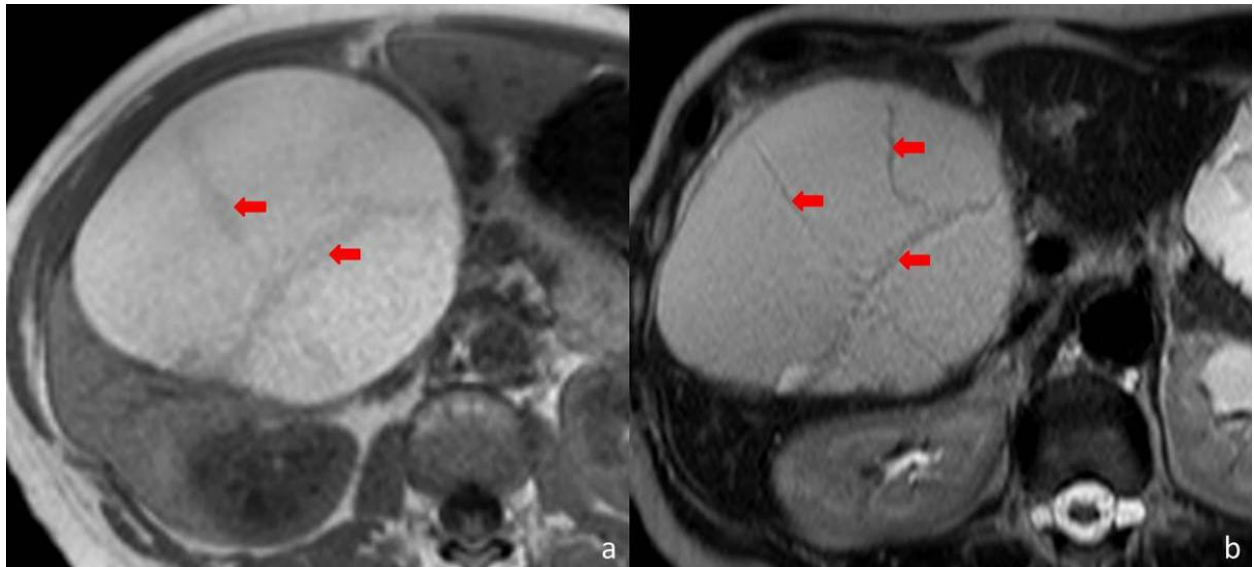


Fig. 18: Abdominal MR showing a biliary cystadenoma with a protein rich fluid content. The lesion content has high signal intensity on both unenhanced T1-weighted (a) and on T2-weighted (b) images. Some septa are seen (arrows) within the cystic lesion.

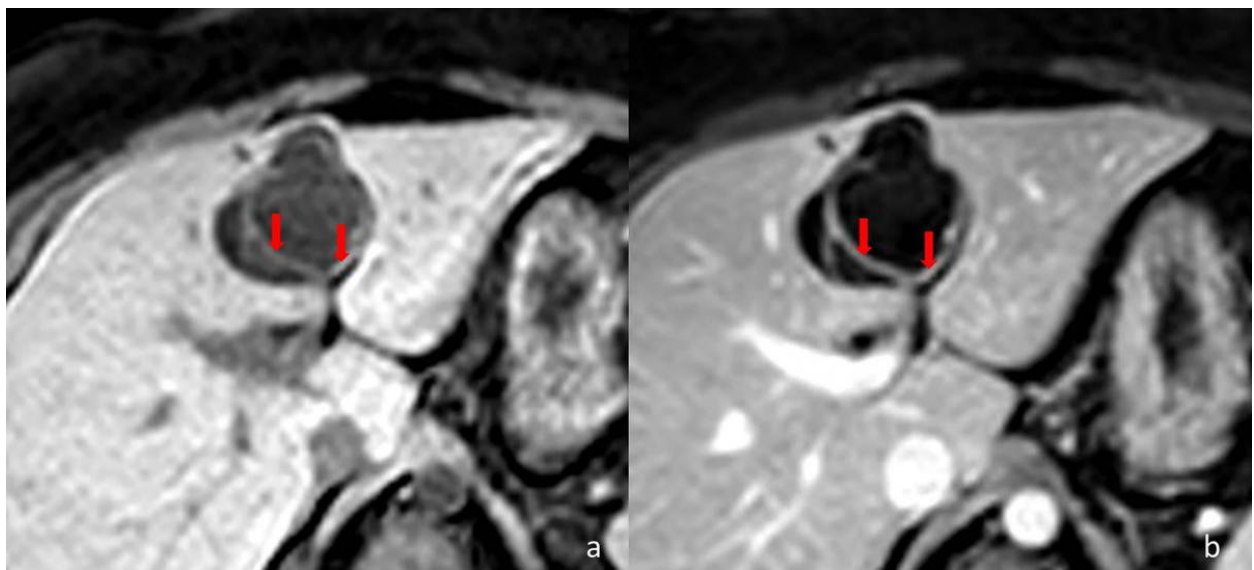


Fig. 19: Axial unenhanced (a) and contrast-enhanced (b) T1-weighted MR images in a patient with biliary cystadenoma. The capsule and septa (arrows) show contrast enhancement within an hypoenhancing fluid content.

Conclusion

Cystic lesions of the liver are common findings with various etiologies. In a majority of cases, radiologic key features together with clinical and laboratorial findings provide enough information for adequate lesion characterization. However, FNAB is sometimes needed for definitive diagnosis. Concerning the great variability of therapeutic and prognostic implications, all efforts should be done to allow an accurate diagnosis and appropriate patient management.

Personal information

References

1. Vachha B, Sun MR, Siewert B, Eisenberg RL. Cystic lesions of the liver. *AJR Am J Roentgenol*. 2011; 196(4):W355-66.
2. Mortelé KJ, Ros PR. Cystic focal liver lesions in the adult: differential CT and MR imaging features. *Radiographics* 2001; 21(4):895-910.
3. Wehmeyer MH, Lohse AW, Schramm C. Some Unusual Cystic Lesions of the Liver. *Gastroenterology* 2013 pii: S0016-5085(13)01009-3
4. Mortelé KJ, Segatto E, Ros PR. The infected liver: radiologic-pathologic correlation. *Radiographics* 2004; 24(4):937-55
5. Vilgrain V, Boulos L, Vullierme MP, Denys A, Terris B, Menu Y. Imaging of atypical hemangiomas of the liver with pathologic correlation. *Radiographics* 2000; 20(2):379-97
6. Brancatelli G, Federle MP, Ambrosini R, Lagalla R, Carriero A, Midiri M, Vilgrain V. Cirrhosis: CT and MR imaging evaluation. *Eur J Radiol* 2007, 61(1): 57-69