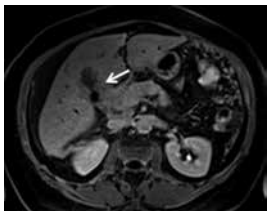

MALIGNANT BILIARY OBSTRUCTION: USUAL AND RECENT IMAGING FINDINGS

Obstrucción maligna de la vía biliar: Hallazgos imaginológicos usuales y recientes

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Summary

Introduction: Malignant biliary obstructions create diagnostic and therapeutic problems. They may originate in primary biliary tumor such as cholangiocarcinoma and gallbladder carcinoma or be secondary to the obstructive effect of neoplasms arising outside the biliary tree, especially ampullar and periampullar lesions. Imaging studies allow us a proper assessment of these malignancies, being essential for diagnosis, and staging and in order to define tumor resectability. ***Objective:*** To make an updated description of the main findings with different imaging modalities in primary and secondary malignant biliary obstructions, considering its usefulness for diagnosis, classification and staging of different types of tumor involvement. ***Methods:*** A search of the literature was performed in PubMed with MeSH terms including biliary, ampullar neoplasm and radiological findings. The search was restricted to the last 10 years. 124 articles were obtained, out of which 60 relevant articles were selected. We present cases of patients with malignant biliary obstruction of different etiologies with the radiological findings. ***Conclusions: R***ecent advances in imaging techniques have enabled a better assessment of the local and distant extent of tumor involvement in patients with malignant biliary obstruction, becoming an essential tool for pre-surgical evaluation and in order to define the appropriate management of these patients.

Resumen

Introducción: Las estenosis malignas de los conductos biliares plantean problemas diagnósticos y terapéuticos. Pueden originarse en lesiones tumorales primarias de la vía biliar, como el colangiocarcinoma y el carcinoma de vesícula biliar o ser secundarias al efecto obstructivo de neoplasias originadas por fuera del árbol biliar, especialmente lesiones ampulares y periampulares. Los estudios por imagen permiten una adecuada valoración de dichas malignidades, por lo tanto son imprescindibles para el diagnóstico, estadiaje y definición de la resecabilidad tumoral. ***Objetivo:*** Hacer una descripción actualizada de los principales hallazgos con las diferentes modalidades de imagen, en las obstrucciones biliares malignas primarias y secundarias, teniendo en cuenta su utilidad para el diagnóstico, clasificación y estadificación en los diferentes tipos de compromiso tumoral. ***Métodos:*** Se realizó búsqueda de la literatura en PubMed con términos MeSH, de neoplasias de vía biliar y neoplasias ampulares con hallazgos radiológicos, en los últimos 10 años. Se obtuvieron 124 artículos de los cuales se seleccionan 60 por su relevancia. Se presentan los hallazgos por imagen de pacientes con obstrucción maligna de la vía biliar de diferentes etiologías. ***Conclusiones:*** Los avances recientes en las técnicas de imagen han permitido una mejor valoración, local y a distancia, de la extensión del compromiso tumoral en pacientes con obstrucción maligna de la vía biliar, por lo que se constituyen en herramientas imprescindibles para la evaluación prequirúrgica y la definición de manejo de dichos pacientes.

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Introduction

Malignant stenosis of the biliary conduits poses several diagnostic and therapeutic problems. These entities may originate anywhere in the biliary tree, as much in small intrahepatic radicals as in the extra-hepatic biliary tract, or they can be secondary to the obstructive effect of non-biliary tumours.

Cholangiocarcinoma (CC) is a malignant primary tumour that originates in the epithelium of the biliary conducts, and is the second most frequent of hepatobiliary tumours. The histological classification most frequently corresponds to adenocarninomas with abundant fibrous stromae.

The CC can be classified, according to their localization, as intrahepatic, perihilar and distal; according to their morphology, in mass forming, intraductal and periductal. Morphology is an important factor to understand the type of growth and local invasion. Besides the primary tumours of the biliary tract, other malignities based in the ampullar and periampullar region may have and obstructive effect, which are manifested with dilation of the intra and extra-hepatic biliary tract; the most frequent are the duodenum carcinoma, adenocarcinoma of the head of the pancreas and tumoural compromise of lymphatic nodules (table 1).

Imaging studies allow making an adequate evaluation of the biliary tract and of the primary biliary malignancies or of the secondary compromise of it. Because of this, they are essential for the diagnosis, in order to define the state and to evaluate resectability.

Table 1. Imaging findings in malignant obstruction of the biliary tract

	US	TC	RM
Intrahepatic cholangiocarcinoma (iCC)	Mass with irregular borders and hypo echoic halo.	Homogeneous attenuation. Initial peripheric enhancement, with late central retention, capsular retraction, satellite nodules and ductal dilation.	High signal in sequences with T2 information, low signal with T1 information, diffusion restriction, peripheric enhancement and central late retention. Proximal duct dilation, satellite nodules and capsular retraction.
Perihilar cholangiocarcinoma (pCC)	Dilation of the intrahepatic biliary tract, with a normal extra-hepatic biliary tract.	Periductal thickening, late enhancement. Dilation of the intrahepatic biliary tract.	Periductal thickening, late enhancement. CPMR: void of signal in ductal confluence. Proximal biliary dilation.
Distal cholangiocarcinoma (dCC)	Dilation of the intrahepatic and extrahepatic biliary tract.	Periductal thickening with late enhancement and dilation of the proximal biliary tract.	Periductal thickening with late enhancement and proximal biliary tract dilation.
Vesicular carcinoma	Mass in the vesicular topography, irregular thickening of the vesicular wall and/or polypoid lesion.	Low density mass with enhancement focci in the vesicular topography. Irregular thickening of the vesicular wall and/or polypoid lesion.	Mass that replaces the vesicle with extension to the liver, thickening of the vesicular wall and/or polypoid lesion. Obstruction in the biliary confluence.
Ampullar carcinoma	Dilation of the biliary tract and the pancreatic duct.	Bulging, irregularity and nodularity of the papilla with dilation of the proximal biliary tract.	Bulging, irregularity and nodularity of the papillae, with dilation of the proximal biliary tract.
Pancreatic carcinoma	Hypo echoic mass in the head of the pancreas.	Low density and hypo vascular mass in the head of the pancreas. Sign of double conduit.	Mass with low signal in sequences with T1 information, slightly high signal in T2 information, hypovascular, with lobulation of the pancreatic contour. Sign of double conduit.
Duodenum carcinoma	Dilation of the biliary tract and the pancreatic duct.	rregular duodenal wall thickening, annular stenosis, frequent transmural compromise. Dilation of the biliary tract.	Eccentric irregular wall thickening, with annular stenosis and transmural compromise. Dilation of the biliary tract.

Malignant stenosis of the biliary tract: imaging methods

Radiological studies, including echography, computerized tomography (CT) and magnetic resonance (MR) with sequences of magnetic resonance cholangiopancreatography (MRCP), constitute the imaging methods most used for the diagnosis and determination of state of bilopancretic neoplasias. The endoscopic retrograde magnetic resonance cholangiopancreatography (ERMRCP) and transparietohepatic cholangiography (TPHC) are complementary techniques necessary for the palliative management of biliary obstruction.

Ultrasound: Is the modality of choice for the initial evaluation of the biliary tract dilation, with a sensitivity of 90% to detect obstruction (1); however, its diagnostic performance to define the cause of the biliary obstruction is lower, between 30-70% (2). It also has limited value in the differentiation between malignant and benign biliary tract lesions (3).

Computerized tomography (CT): It is useful to detect biliary tract dilation, the underlying cause of obstruction and complications such as cholangitis and abscesses. It can contribute to differentiate among

malign and benign biliary tract obstruction (4). The main tomographic characteristics that suggest malignant dilation are: enhancement in arterial phase and portal of the biliary tract walls, wall thickening above 1.5 mm, longer length of stenosis (medium of 17.9 mm in malignant stenosis vs. 8.9 mm in benign) and a higher level of proximal dilation (4).

CT allows to make multiplanar reconstructions with an adequate anatomical detail of the biliary tract, of the ampullar, periampullar region and vascular structures, which is useful for the determination of tumoural state and to predict resectability with an adequate diagnostic performance. It is useful to evaluate the extension and vascular compromise; it, however, has low sensitivity (61%) for the detection of nodal compromise (5,6).

Magnetic resonance cholangiopancreatography (MRCP): MR has a better contrast resolution and this allows for a better definition of intra and periductal lesions. Parallel imaging techniques and the use of respiratory monitoring have improved its spatial resolution, with a better biliary tract detail. The MRCP contributes to differentiate benign stenosis from malignant. In a study by Kim and collaborators, six characteristics are described that are considered predictive of malignancy: stenosis with length above 12mm, asymmetric wall thickening, lumen irregularity, enhancement of the higher wall of the hepatic parenchyma, wall thickness above 3mm and badly defined margins. The authors inform of a sensitivity of 100% with specificity of 87% for the diagnosis of malignant stenosis, when at least three of these criteria are met (7). The MRCP constitutes the method of choice when faced with the suspicion of malignant biliary obstruction, with a diagnostic performance of 71-96%, to detect the level of obstruction and tumoural extension (8).

Endoscopic retrograde magnetic resonance cholangiopancreatography (ERMRCP): ERMRCP allows for an adequate evaluation of tumoural extension, though it is an invasive study, for which it has been replaced by the MRCP for the diagnosis of malignant biliary obstruction. It is the definitive diagnostic method for ampullar neoplasias, since it allows for the direct visualization of the papillae and for taking biopsies (9). The brushing of the biliary tract for cytological study has a variable diagnostic performance between 9-57% (10).

Its main use is fundamented in the palliative management of biliary obstruction along with TPHC, to obtain its therapeutic decompression through biliary prothesis, in those patients with non-resectable tumours (10,11).

Endoscopic ultrasound (EU): The EU with fine needle aspiration is an alternative method for the visualization and sample taking of the extrahepatic biliary tree, of hilar masses and lymphatic nodules. It has a higher sensitivity for the detection of distal compromise when compared to proximal compromise of the biliary tract. The EU is the study of choice for sample taking when malignity is suspected in the head of the pancreas (12).

Malign obstruction in the biliary tract

Cholangiocarcinoma (CC)

The CC is the second most frequent liver malignity. It is diagnosed usually in patients above 65v years of age, with a slight prevalence in men. In the majority of cases its aetiology is unknown, though factors that produce chronic inflammation of the biliary tract, such as primary and secondary sclerotic cholangitis and hepatolitiasis are considered risk factors (13,14).

Congenital disorders, such as Caroli disease and choledocum cysts are associated to the development of CC. The risk of having this malignity during life in these conditions is approximately 15%. Surgical management does not completely prevent carcinogenesis, for which this entity is present in up to 1% of said patients (15). Infection from hepatitis C, alcohol abuse and cirrhosis of any aetiology increase the risk of CC (16).

Morphological classification

According to the morphological classification proposed by the *Liver Cancer Study Group of Japan* (LCSGJ), CC is classified as: mass forming, periductal infiltrative and of intraductal growth (17).

The *mass forming* CC is originated in the peripheric bile ducts. It presents as solid masses in the hepatic parenchyma, associated to dilation of the biliary tract peripheric to the lesion and capsular retraction (figure 1) (18).

The *periductal infiltrative* grows through the walls of the biliary tract, produces a concentric wall thickening, with stenosis or obstruction, without mass formation. It disseminates through the periductal connective tissue, and the lymphatic and perineural compromise is more frequent than in other types (18).

Intraductal type presents itself as a papillar or polypoid tumour within the light of a dilated bile duct and disseminates along the mucous surface. In some cases these intraductal tumours produce a great quantity of muccine, with marked biliary tract dilation distal to the tumour (19).

In CC the tumoural dissemination occurs as much by longitudinal extension through the biliary tract, as by axial growth, with compromise of tissue and adjacent organs. Longitudinal growth differs according to the macroscopic type: the mucous extension presents predominantly in the tumours with intraductal growth and mass forming, while sub mucous extension occurs predominantly in the periductal infiltrative type (19).

Anatomical classification

CC is classified, also, according to its localization in the biliary tree: intrahepatic (iCC), perihilar (pCC) and distal (dCC). The reference point to differentiate iCC from pCC are the second order bile ducts. Tumours originating in the right, left or common hepatic conduits are considered perihilar. From the insertion of the cystic conduit it is considered dCC (20).

Intrahepatic cholangiocarcinoma

Corresponds to 10% of the cases. It constitutes the second most frequent malignity in the liver, after hepatocellular carcinoma. The most frequent morphological type is the mass forming, with a frequency of 86% (21).

Imaging findings

In ultrasound a homogenous mass is observed, with defined borders. Tumours above 3 cms are generally of high echogenicity and those of smaller size have low echogenicity (22).

In CT they are manifested as a homogeneous, low-density mass with irregular yet well defined margins with incomplete peripheric

enhancement in the arterial phase. The central region highlights in late acquisitions, between 5 to 10 minutes after the administration of contrast medium, reflecting the amount of fibrous stromae of the tumour (23). Some tumours can have an atypical pattern with heterogeneous and peripheric arterial enhancement, pattern that occurs in patients with chronic hepatopathy (24).

Other findings are capsular retraction, which is found in 21% of the cases, and intrahepatic peripheric bile duct dilation adjacent to the lesion. It is common that this neoplasia surrounds the vascular structures, however, intravascular tumoural thrombi are rare (18).

In MR they are generally lesions with low signal in sequences with T1 information, high signal in sequences with T2 information and present a enhancement pattern similar to the one described in computerized tomography (figure 2).

The behaviour of lesions with the administration of organ-specific contrast medium varies according to the quantity of fibrous stromae. With the use of gadoxetic acid the pattern of enhancement is more frequent in the arterial progressive ring in dynamic series. However, the tumour is low signal with respect to hepatic parenchyma, as much in dynamic as in hepatobiliary phases, with an appearance of "pseudo-cleansing" . In 47% of patients it is visualized as a "target" lesion in the hepatobiliary phase (25). It has been shown a better definition of the borders of the lesion and a higher detection of satellite and metastatic lesions with the use of organ-specific contrast media (26).

In the diffusion sequences restriction to tissue diffusion is not observed in the central fibrotic area, while the peripheric zone presents restriction due to its higher cellularity (27,28).

Surgical resection constitutes the only curative treatment, but the percentage of resectable tumours at the moment of diagnosis is very low, between 10 to 20%.

It is considered that patients with multiple lesions, metastatic compromise and extensive vascular invasion are not candidates for surgical management (20). The compromise of lymphatic nodules is not contra-indicative for surgery, though it is an independent factor with bad prognosis (29).

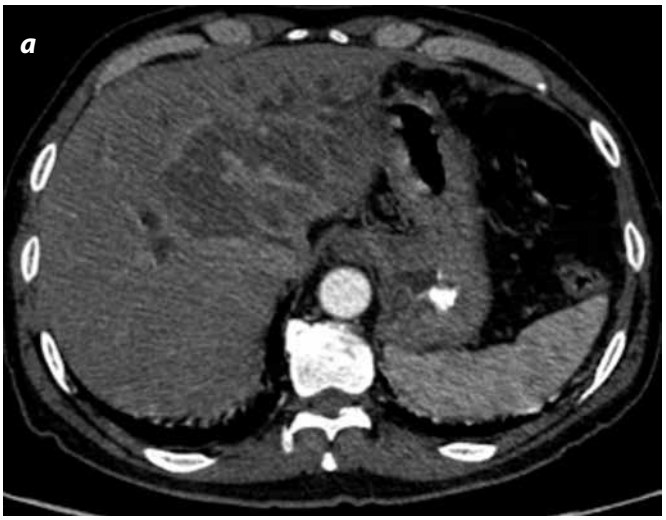
The CT and MR have similar diagnostic performance to evaluate vascular compromise, with sensitivity of 82-90% for arterial compromise and of 95-98% for compromise of the portal vein (30). For the detection of ganglionic affection both techniques present a similar diagnostic performance, of 77% (31).

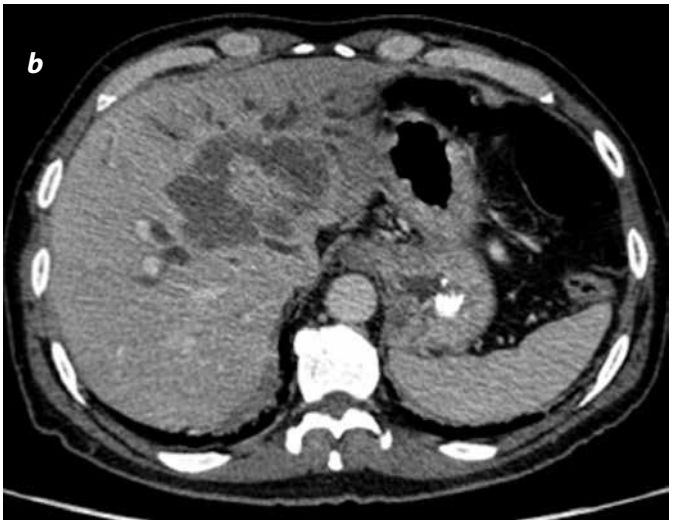
The sensitivity of positron emission tomography/ computerized tomography (PET/CT) is relatively better for the detection of intrahepatic cholangiocarcinoma than for perihilar or distal. However, it does not present advantages with respect to tomography or MR for diagnosis (32), its advantage being a higher detection of ganglionic and metastatic compromise (33,34).

Perihilar Cholangiocarcinoma

Corresponds to 50% of the cases. These are the tumours that compromise the right, left and common hepatic conduits. Also known as Klatskin tumour. The most frequent growth patterns are the periductal and mixt.

It is classified by the Bimusth-Corlette in four types according to the level of biliary obstruction (figure 3).





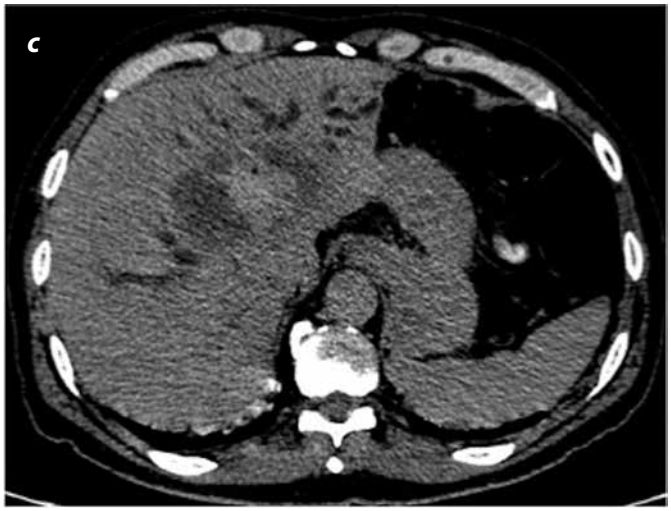


Figure 1. a) Mass forming cholangiocarcinoma. Axial CT images in arterial phase. b) Portal. c) Late at 10 minutes: Hypo vascular mass with irregular borders, with early peripheric enhancement and retention of contrast medium in the centre of the mass in late acquisitions. Dilation secondary to the intrahepatic biliary tract.

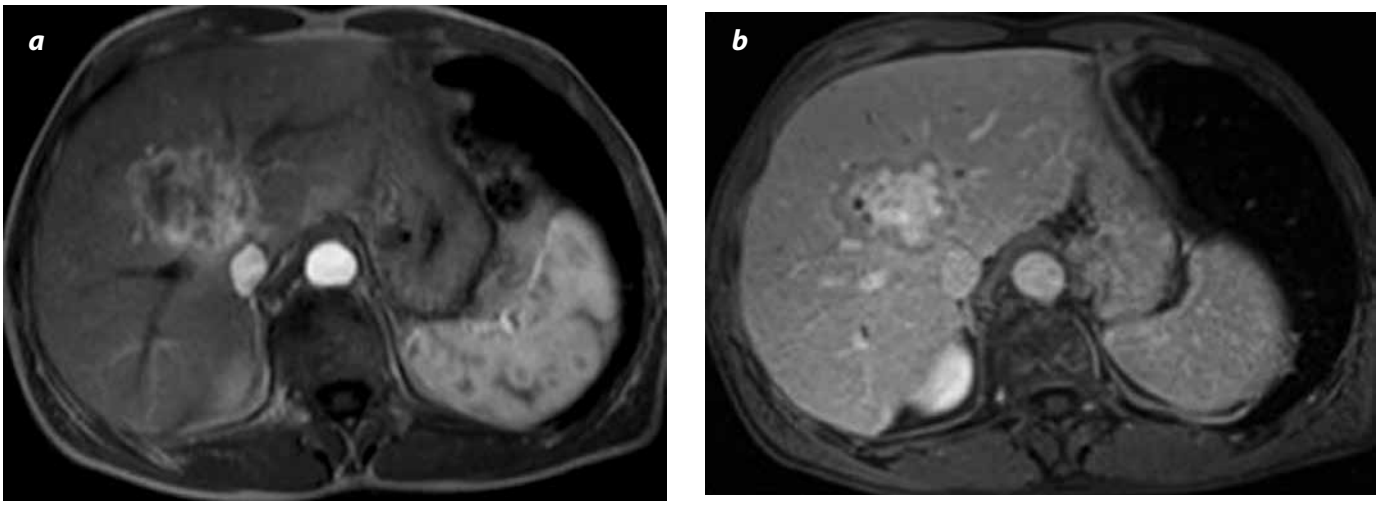


Figure 2. Intrahepatic cholangicarcinoma. Sequences with T1 information. a) With contrast medium in arterial phase. b) Heterogeneous enhancement, of peripheric prevalence with retention of contrast medium of central prevalence in the late phase.

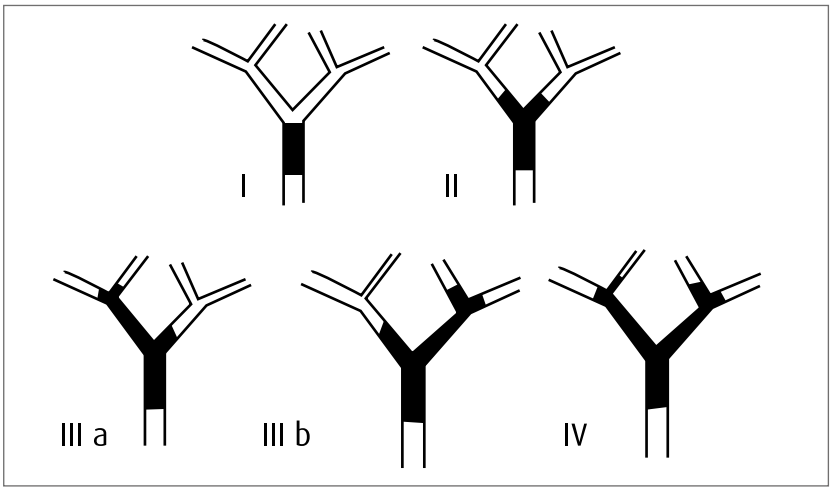


Figure 3. Bismuth-Corlette classification
Type I: Compromise of the common hepatic conduit below the confluence. Type II: Compromise of the confluence of the right and left hepatic conduit. Type III: Extension to the bifurcation of the right (III a) or left (III b) hepatic conduit. Type IV: Compromises the right and left hepatic conduits, the secondary intrahepatic bile ducts or multiple and discontinuous sites in the right and left conduits.

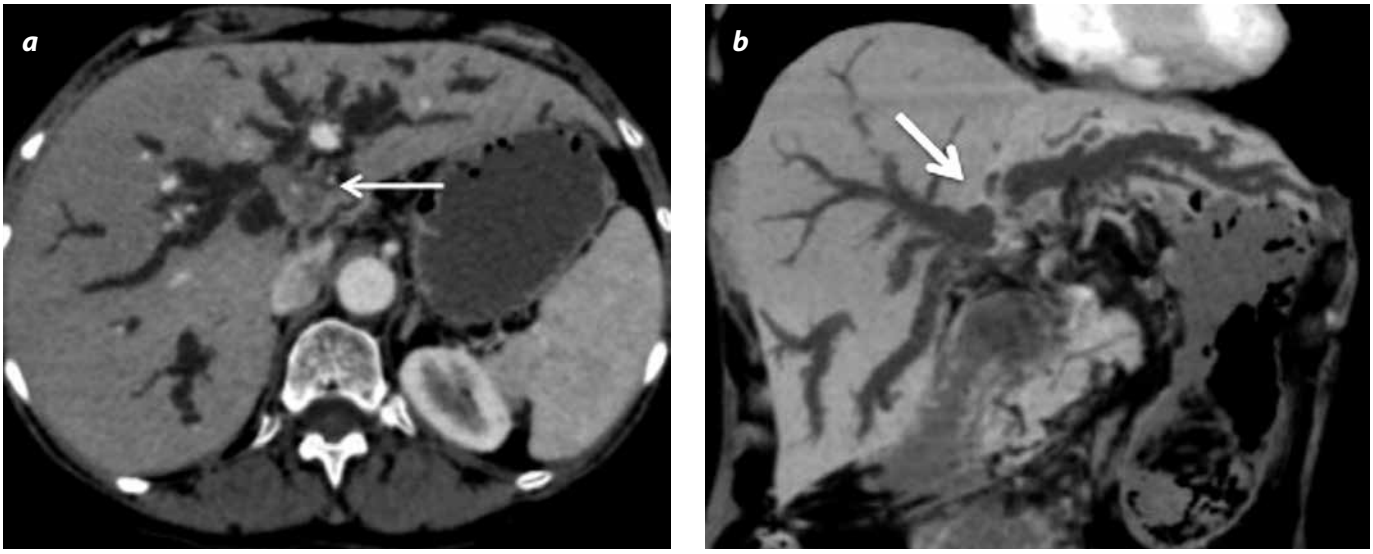


Figure 4. Hilar cholangiocarcinoma. (Klatskin tumour). a) CT with contrast medium in the portal phase: Hilar mass of low density with secondary dilation of the intrahepatic biliary tract (arrow). b) Minimum density reconstruction in the coronal plane: dilation of the biliary tract with right and left duct compromise by a Bismuth II obstruction (arrow).

Imaging findings

In ultrasound the characteristic finding is the dilation of the intrahepatic biliary tract, usually without extra-hepatic dilation.

In CT and MR it is seen as a wall thickening with stenosis or obliteration of the light and dilation of the proximal biliary tract. It has circumferential growth along the bile ducts. It is frequent its local extension from the biliary tract to the hepatic parenchyma (figure 4) (35).

In sequences with T1 and T2 information, generally the tumour is barely visible, iso-moderately hypo intense in the sequence with T1 information with regards to the hepatic parenchyma and of medium or slightly high signal in sequences with T2 information. It presents enhancement in the arterial or portal phase, with a peak in late acquisitions (figure 5). In MRCP sequences it can be seen as a zone with empty signal. The tumour presents restriction to tissue diffusion. The diffusion sequence has a PPV (positive predictive value) of 100% and a NPV (negative predictive value) of 91.3% (36). The ADC (apparent diffusion coefficient) is correlated directly with the degree of tumoural differentiation (37).

The use of organ-specific contrast medium allows for an adequate evaluation of the tumoural compromise. However, the hepatobiliary phase does not provide additional information with respect to the dynamic phases. Besides, only in 13% of these patients does contrast medium pass to the biliary tract, due to the high levels of bilirubin that saturate the trans membrane transporters, for which cholangiography is limited in sequences with T1 information in patients with jaundice or biliary tract obstruction (38).

The radiological study is fundamental for the pre-surgical evaluation and always must evaluate the extension of the tumour, the presences of hepatic infiltration, the vascular, nodal and metastatic compromise.

Presently MR with MRCP sequences is considered the study of choice to determine tumoural resectability. The most widely accepted non-resectability criteria are the Memorial Sloan-Kettering Cancer Centre (MSKCC) (table 2) (39).

Table 2. Hilar cholangiocarcinoma unresectability criteria

Patient factors	Medical disorder that makes him/her intolerable for major surgery. Hepatic cirrhosis.
Local tumoural characteristics	Bilateral tumoural extension to secondary bile ducts. Encircling or occlusion of the main portal vein proximal to its bifurcation. Hepatic lobule atrophy with contralateral tumoural extension to secondary bile ducts. Unilateral tumoural extension to secondary bile ducts with compromise of the contralateral portal ramification.
Metastasis	Metastasis to N2* confirmed histologically. Hepatic, pulmonary or peritoneal metastasis.

* Metastatic disease to peripancreatic, periduodenal, celiac, superior mesenteric, posterior pancreatoduodenal lymph nodes

Due top the tendency of CC to produce perineural invasion, tumoural extension can be underestimated. However, periductal enhancement is very suggestive of infiltrative compromise (40).

It must be taken into account that prostheses in the biliary tract produce inflammatory changes that can be erroneously interpreted as tumoural compromise and overestimate the extension of the lesion. As such, in every patient with cholangiocarcinoma suspicion an MR must be performed previous to any biliary intervention, to achieve an adequate determination of state (41).

The PET/CT has low sensitivity for the detection of the primary tumour, due to its low intake of FDG, for which it is of better use for the evaluation of metastasis and nodal compromise (42).

Distal cholangiocarcinoma

It is considered a distal CC if it is originated in the choledocum, between the insertion of the cystic conduit and the Vater ampulla, and it represents about 20-40% of CC (43).

Its radiological appearance, similar to hilar CC, presents thickening of the choledocum wall, late enhancement and abrupt termination of this, associated to dilation of the biliary tract proximal to the zone of stenosis. Infiltrative thickening of the wall can be observed or, less frequently, a nodular or intraductal papillar mass that simulates the presence of calcifications.

In MR, MRCP and dynamic sequences allow for a better evaluation of the zones of stenosis, which allow differentiating malign obstructions from benign. Malign obstructions have a higher enhancement of the wall in the portal and equilibrium phase, higher length of stenosis and higher proximal dilation (44) (figure 6). Similar to pCC, it presents restriction due to tissue diffusion (37).

The use of PET/CT is limited for the evaluation of the primary tumour, but useful for the detection of ganglionic and at distance metastasis.

Surgical treatment, the Whipple procedure, has a 5-year survival rate of 27% in patients with negative tumour resection margins (45,46).

Biliary vesicle Carcinoma

It is the most common biliary tree carcinoma. Generally in late stages at the moment of diagnosis, with nodal and adjacent structures affectation.

The US is the initial imaging modality, with a high sensitivity for the detection of advanced carcinoma, however its performance is low in the detection of early lesions. Ultrasound findings are: mass that replaces the vesicle, thickening of the vesicular wall or polypoid lesion (47). In CT and MR the most characteristic finding is a mass that replaces the biliary vesicle and extends towards the hepatic parenchyma (figure 7).

In the CT the tumour manifests in the simple phase as a low-density mass in the simple phase, with heterogeneous enhancement with contrast medium. Necrosis zones can be visualized.

The MR allows a better tissue characterization and thus, better evaluation of the lesion. It manifests as a focal or diffuse wall thickening with a thickness greater to 1 cm. In sequences with T2 information the lesion is heterogeneous, predominantly of high signal; with low signal in sequences with T1 information and with early irregular enhancement after the administration of contrast medium (48).

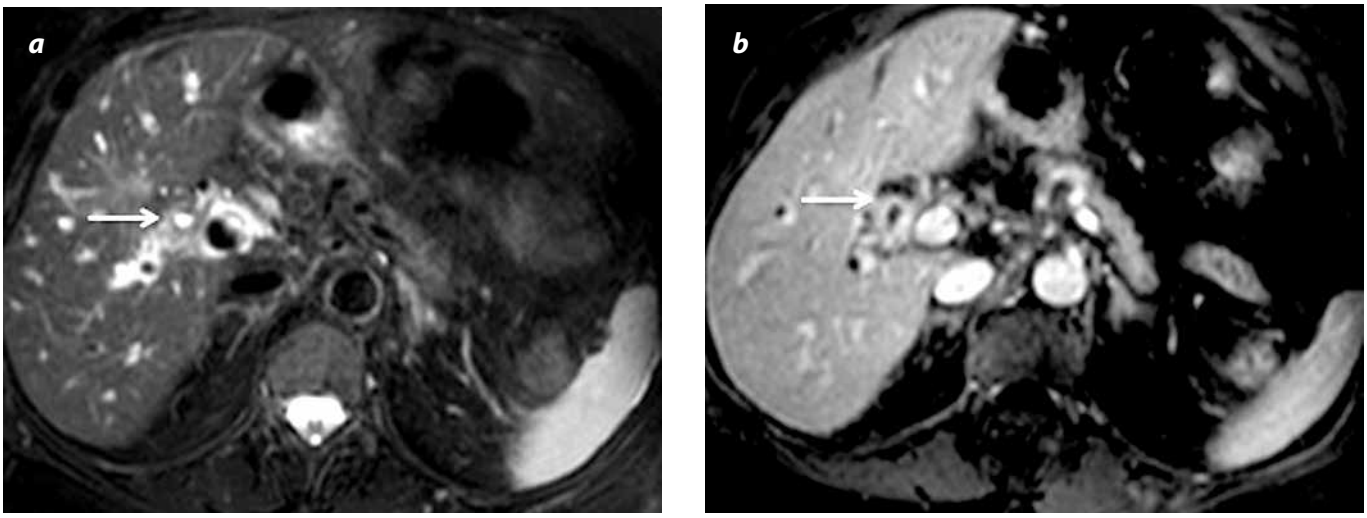


Figure 5. Periductal cholangiocarcinoma infiltrative of the common hepatic conduit. a) MR with T2 information and fat suppression: Segmentary wall thickening of the common hepatic conduit (arrow). b) MR with T1 information and contrast medium in portal phase: Wall enhancement (arrow).

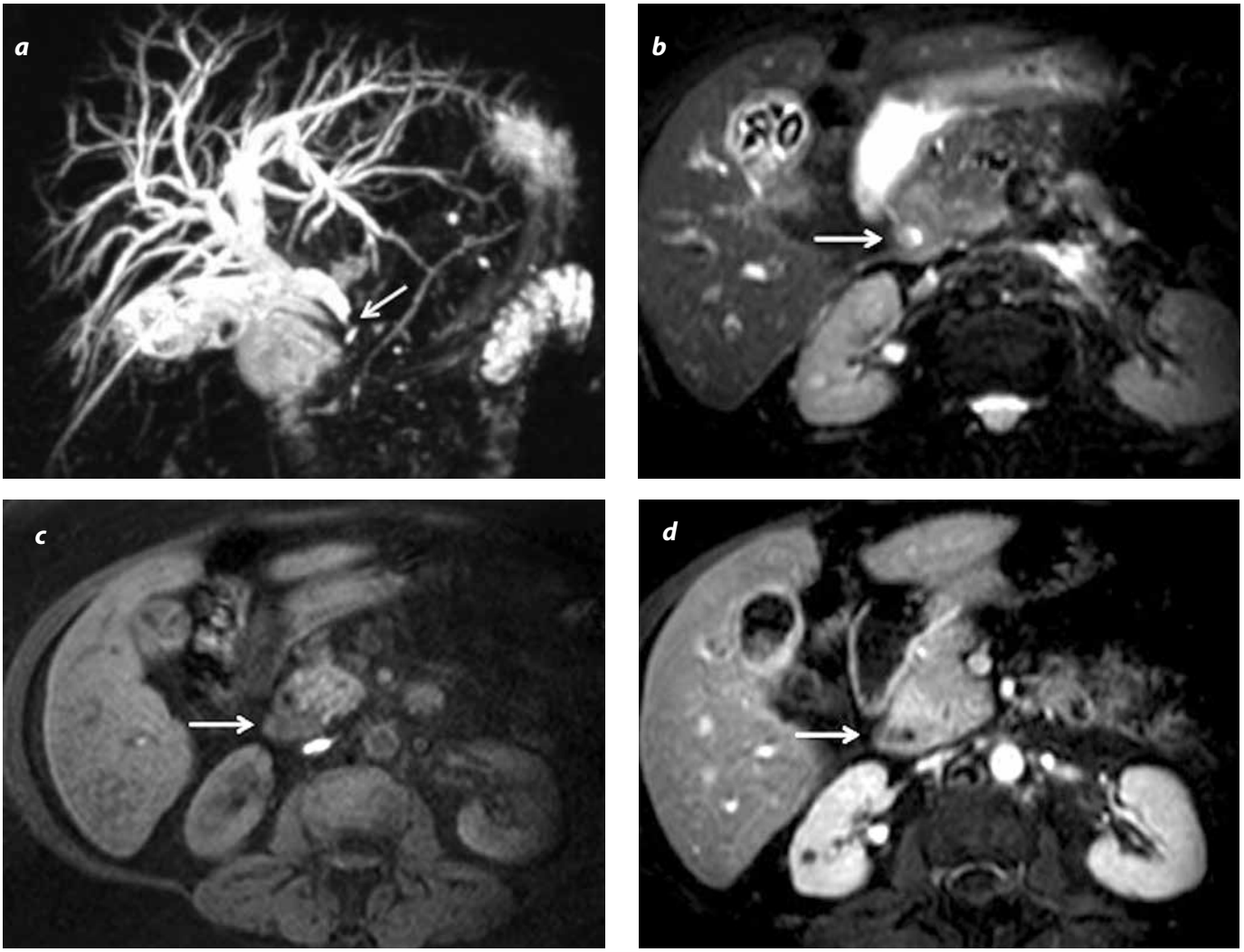


Figure 6. Distal periducat cholangiocarcinoma. a) MRCP with 3d reconstruction: dilation of the intra and extra-hepatic biliary tract up to the distal third with abrupt stenosis of the distal choledocum (arrow). b) MR sequences with T2 information with fat saturation: High signal periductal infiltrative tissue. c) MR with T1 information: The lesion has low signal. d) With slight enhancement with contrast medium in acquisitions with T1 information and fat saturation and gadolinium administration. Note besides cholelitiasis and vesicular wall thickening due to inflammatory compromise.

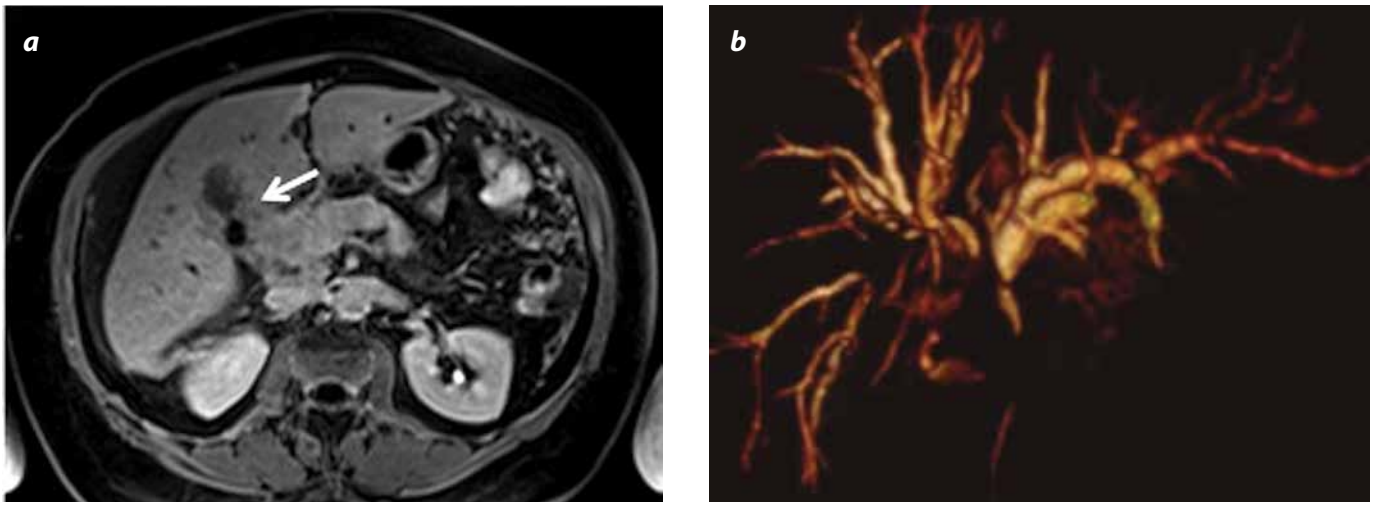


Figure 7. Biliary vesicle carcinoma. a) MR with T1 information with contrast medium, gadoxetic acid and fat saturation in hepatobiliary phase: irregular thickening of the vesicular wall with infiltration of the hepatic parenchyma (arrow). b) Obstruction of the intra and extra-hepatic biliary tract evident in volumetric reconstruction.

About 25% of neoplasias are observed as polypoid lesions. Malignant lesions are generally bigger than 1 cm and have an implantation base in the vesicular wall (47).

The obstructive compromise of the biliary tract is found in 50% of the patients, can be secondary to the compressive effect of the tumour, to direct invasion or to adenopathies. Said compromise is best observed in MRCP sequences (9).

The diffusion sequence contributes to the diagnosis of vesicular carcinoma by improving the diagnostic performance of conventional MR, with a sensitivity of 94% and a specificity of 88.9% (49). However, inflammatory changes can present restriction to tissue diffusion, which makes it difficult to differentiate between these two conditions.

In PET/CT the accumulation of F18-FDG suggest malignity. However, it does not present advantages with respect to CT or MRI for the detection of the primary tumour. Its main advantage is in its higher sensitivity for the detection of adenopathies and at distance metastasis (50).

Biliary obstruction secondary to non-biliary lesions

Vater ampulla carcinoma

It is a malignity that originates in the epithelium of the Vater ampulla, generally detected when the lesions are small due to early obstructive symptoms it presents.

For the evaluation by images, CT (6) and specially MR (51) are useful.

The majority of lesions are presented as a discrete nodular mass that produces an irregular filling defect in the distal margin of the pancreatobiliary junction (52). The differentiation of ampullar neoplasias with inflammatory conditions can be difficult. The dilation of the biliary tract and the pancreatic conduit are not specific, as they can be observed both in the malignant pathology as in the benign. The imaging findings that suggests malignity are: infiltrative or hypo vascular polypoid mass, bulging of the papillae with irregularity and nodularity of the contour and wall thickening above 3mm (figure 8) (51).

The ERMRCP is a definitive diagnostic procedure that allows the direct visualization of the ampulla and to take biopsies. However, in non-exposed lesions with normal duodenal mucus, the endoscopic study may not be conclusive.

The endoscopic ultrasound constitutes the best technique for the detection of small ampullar tumours, which do not yet have exposure through the papillae (51).

Duodenal adenocarcinoma

The duodenal adenocarcinoma is the most frequent of those present in the small intestine, with 50% of the cases. The patients generally present themselves in advanced stages, with metastasis at the moment of diagnosis (53). They are seen as annular stenosis with irregular borders, nodular lesion or as an ulcerated lesion. If the tumour is localized in the peri-ampular region it has an obstructive effect and produces dilation of the biliary tract and the pancreatic duct (figure 9) (54).

In CT and MR they are generally observed as infiltrative lesions that affect short segments and cause gradual luminal stenosis and obstruction with pre-stenotic dilation. The presence of intraluminal polypoid masses is less common. With the use of contrast medium, it presents moderate heterogeneous enhancement, such as hypo vascular lesions. They tend to infiltrate the entire intestinal wall and to extend to the mesenteric fat, which produces local desmoplasic reaction (53,55).

Pancreas adenocarcinoma

This adenocarcinoma accounts for 85-90% of all malignant pancreatic neoplasias and is the second most frequent gastrointestinal malignity. The majority is localized in the head of the pancreas (60-70%), which creates a compressive effect on the biliary tract.

CT constitutes the main method for its diagnosis and stage determination. The majority of tumours show as low-density masses, with poor and heterogeneous enhancement with contrast medium (56).

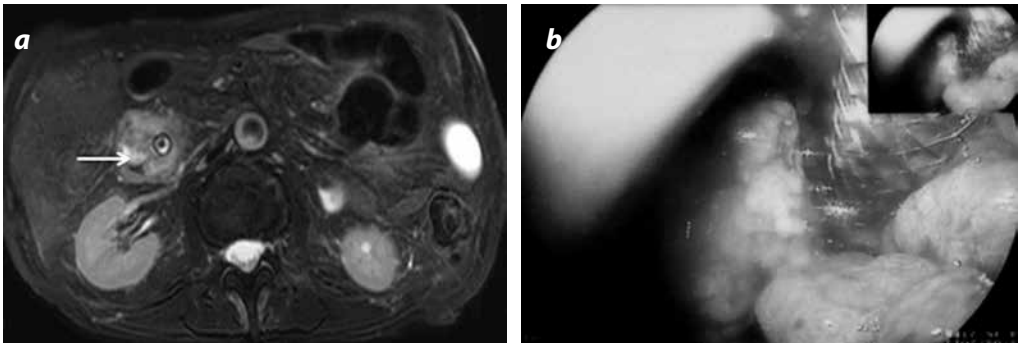


Figure 8. Vater ampulla carcinoma. a) MR sequence with T2 information, axial plane with fat saturation: mass of localized intermediate signal in the Vater ampulla (arrow), with obstructive effect that produces dilation of the biliary tract. Prosthesis in choledocum, surrounded by the mass. b) Endoscopic study; ampullar mass, surrounded by prosthesis.

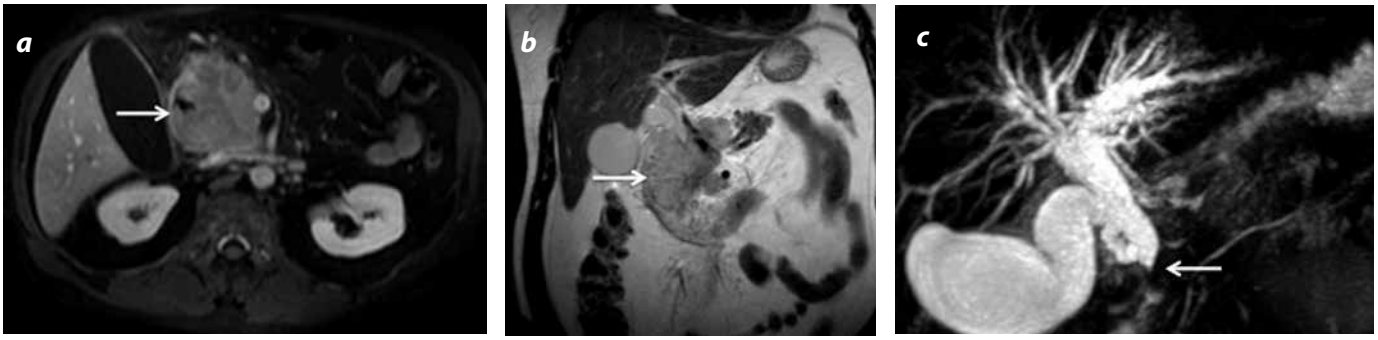


Figure 9. a) MR sequence with T1 information with gadolinium administration and fat saturation (arrow). b) Sequence with T2 information in the coronal plane; localized mass in the second portion of the duodenum (arrow) which compromises the ampullar and periampullar region. Enhancement with gadolinium has intermediate signal in sequences with T2 information. c) MRCP: dilation of the intra and extra-hepatic biliary tract with obstruction of the distal choledocum. The pathological study showed a duodenal adenocarcinoma (arrow).

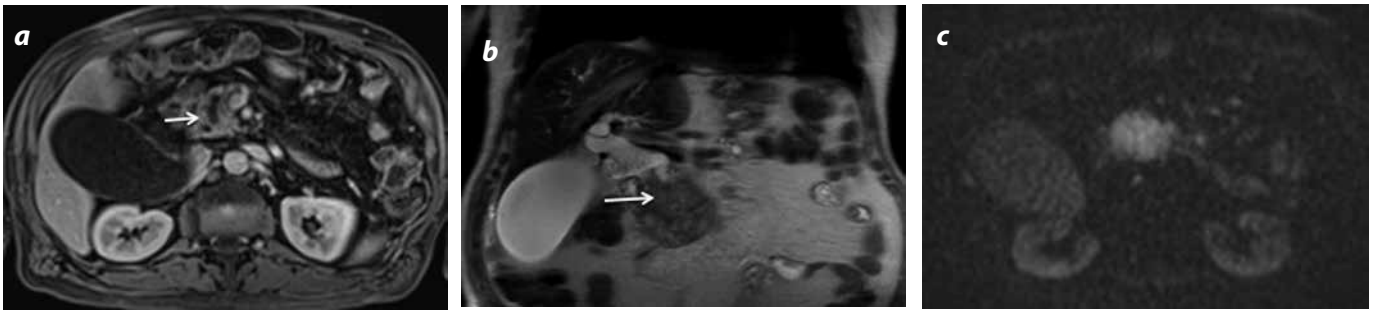


Figure 10. Pancreas adenocarcinoma. a) MR with T1 information with contrast medium and fat saturation: localized mass in the head of the pancreas (arrow). c) Diffusion sequence, with a b value of 800: high signal of the mass by restriction due to tissue diffusion.

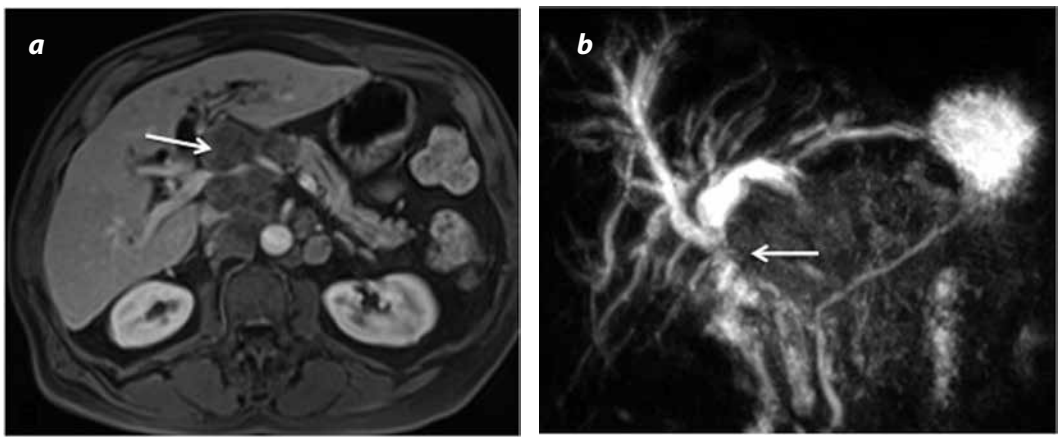


Figure 11. Obstruction secondary to adenopathies. a) Axial MR with T1 information with contrast medium and fat suppression: conglomerate of retroperitoneal, peripancreatic adenopathies (arrow). b) Pancreatic-duodenal with compressive effect over the choledocum that produces dilation of the intrahepatic biliary tract as observer in the MRCP sequence (arrow).

In small tumours, of similar density to that of the pancreatic parenchyma, MR has a better diagnostic performance due to its higher contrast resolution (57).

The majority of pancreas adenocarcinomas are low signal in sequences with T1 information, medium or slight high signal in sequences with T2 information. They produce alteration or lobulation of the pancreatic contour and do not show important enhancement with the contrast medium, which makes them to be classified as hypo vascular tumours (figure 10) (58).

Other findings are the dilation of the main pancreatic duct and the biliary tract, the "sign of double conduit".

The stage determination depends on the tumoural size, the local extension, and the vascular and metastatic affection. The unresectability criteria are: presence of metastasis, compromise of the superior mesenteric artery and the celiac trunk above 180 degrees, and the non-constructible occlusion of the superior mesenteric vein and the portal vein (59). The treatment is surgical, however, it is of poor prognosis, with unresectability at the moment of diagnosis in 75% of the cases (56).

Lymphadenopathies

The periportal ganglionar compromise, pancreatic-duodenal and peripancreatic adenopathies can generate an obstructive effect over the biliary tract (figure 11).

The periportal adenopathies frequently cause obstruction of the extra-hepatic biliary tract. Many primary neoplasias can compromise these nodules including the neoplasias whose origin is: vesicle, biliary tree, liver, stomach, pancreas, colon, lung, breast and lymphoma (60).

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