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Cholangiocarcinoma and its Mimics: A Radiological Dilemma

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ABSTRACT **INTRODUCTION:**

Cholangiocarcinoma is one of the most common hepatobiliary malignancies. The diagnosis of cholangiocarcinoma is a challenge since there is a large group of diseases which have a close resemblance of its radiological appearance. These conditions may vary from non-neoplastic diseases like primary sclerosing cholangitis, HIV cholangiopathy to neoplasms like Gall bladder carcinoma, hepatocellular carcinoma, and metastasis. In view of such a wide range of neoplastic and non-neoplastic conditions mimicking cholangiocarcinoma, imaging findings are undoubtedly essential in making the diagnosis and they also need to be followed by histopathological examinations since most of these entities have a characteristic pathological appearance along with non-specific clinical & radiological picture. This might help in deciding the course of management to prevent further complications. The objectives of our study are:

- 1. To evaluate the wide spectrum of radiological presentation of cholangiocarcinoma in CT and MRI
- 2. To emphasize the role of biopsy in definitive diagnosis

This may help in establishing the importance of histopathological correlation in suspected cases of the group of entities which mimic the radiological appearance of cholangiocarcinoma.

METHODS:

We retrospectively reviewed cases with a similar radiological appearance as cholangiocarcinoma. This study comprises of 20 patients referred for CT and MRI study to our department during March 2020 to September 2020.

We evaluated the multimodality imaging findings of these conditions, which had near certain radiological imaging appearances or which were later confirmed by histopathologic examination of biopsy specimen.

RESULTS:

In our sample of 20 cases, the most common presentation was found to be liver metastasis followed by other important causes like cholangiocarcinoma, hepatocellular carcinoma, and cholangitis.

Keywords: Cholangiocarcinoma, cholangitis, HIV cholangiopathy, HCC, GB carcinoma, metastasis **INTRODUCTION**

Cholangiocarcinoma is a rapidly growing neoplasm of biliary epithelium. It is currently 2nd most common primary hepatobiliary malignancy with continuously increasing morbidity as well as mortality. Its radiological presentation comprises a wide spectrum which may differ according to its location [intrahepatic, perihilar, or distal] and morphology [mass-forming, periductal infiltrating, and intraductal growing]. A wide variety of

presentation it misdiagnose makes easy to cholangiocarcinoma.

Many non-neoplastic as well as neoplastic conditions also tend to mimic its radiological appearance. Some of the inflammatory and infective pathologies masquerading as cholangiocarcinoma are primary sclerosing cholangitis, pyogenic recurrent cholangitis, acquired immunodeficiency syndrome cholangiopathy, xanthogranulomatous cholangitis,

whereas some of the neoplastic conditions are hepatocellular carcinoma, metastases, gall bladder carcinoma etc. The treatment in these conditions are variable varies whereas the definitive treatment of cholangiocarcinoma is surgical resection, hence it is crucial to make an early diagnosis of the carcinoma to prevent further complications. Most of the afore mentioned pathologies can be differentiated from cholangiocarcinoma by histopathology making biopsy as the definitive diagnostic tool in case of radiological dilemma.

The aim of our study is to exhibit the imaging findings in the above pathologies which have similar presentation as cholangiocarcinoma. Considering this wide array of radiological mimics of cholangiocarcinoma, we need to identify the primary pathology which requires biopsy for confirmation as well as further assessment.

MATERIAL AND METHODS:

This is a descriptive study of retrospectively reviewed cases of hepatobiliary diseases in 20 patients who were referred for CT and MRI study to Department of Radio-diagnosis in our hospital during the period of March 2020 to September 2020. All our patients were imaged in our institution. CT scans were done using a Siemens SOMATOM SCOPE 32 slice CT scanner, whereas MRI was done using Siemens 1.5 T MAGNETOM ESSENZA MRI scanner.

RESULTS:

In our sample of 20 cases, the most common condition mimicking cholangiocarcinoma was liver metastasis.



1. DISCUSSION:

Cholangiocarcinoma is an important biliary tract tumour with its origin from bile duct epithelium⁽¹⁾. It is the most common malignant neoplasm of biliary tract⁽²⁾. It closely follows hepatocellular carcinoma as the 2nd most common primary hepatic neoplasm^(2,3) accounting for 10–15% of all primary hepatic malignancies⁽⁴⁾. Various risk factors for cholangiocarcinoma are^(2,5) as follows:

- Liver flukes [Clonorchiasis]
- Infective conditions like HIV, HBV
- Congenital anomalies of bilio-pancreatic tree like congenital hepatic fibrosis, choledochal cyst
- Liver Cirrhosis
- Hepatolithiasis

- Chronic biliary inflammatory conditions like primary sclerosing cholangitis
- Biliary tract-enteric drainage procedures
- History of exposure to Environmental or occupational toxin (Thorotrast)

The presence of above risk factors raises a high degree of clinical suspicion which demands radiological evaluation for making a timely diagnosis, accurate staging, and assessment for resectability. It is the most difficult to diagnose among all gastrointestinal cancers and consequently leading to a 5-year survival rate of less than 10% with poor prognosis ^(6,7).

Classification

Classification system proposed by the Liver Cancer Study Group of Japan is based on radiologicpathologic correlation. It categorizes cholangiocarcinoma based on morphology and growth patterns ⁽⁸⁾ into three types:

- 1. Mass-forming type.
- 2. Periductal infiltrating type.
- 3. Intraductal growing type

This classification has proven invaluable for assessment of tumour dissemination, prognosis, and management of cholangiocarcinoma. For example -Intraductal growing type is slow growing tumour with best prognosis among all three types.

Imaging appearances of the above-mentioned cholangiocarcinoma types are as follows:

1.MASS-FORMING CHOLANGIOCARCINOMA

CT findings:

-Homogenously attenuating, regular and well-defined marginated homogenous mass.

Soft tissue mass on NCCT.

-On CECT characteristic irregular peripheral enhancement with gradual centripetal enhancement in the delayed or equilibrium phase is seen. Capsular retraction is also an important feature. Satellite nodules may be cholangiocarcinoma occasionally present.

MR Imaging:

- The mass shows low signal intensity on T1WI and High on T2WI. Imaging with IV contrast provides a similar picture as CECT of characteristic irregular peripheral enhancement with gradual centripetal enhancement in the delayed or equilibrium phase.



(A)

Fig 1: Mass forming cholangiocarcinoma: Contrast enhanced MRI shows a well-defined mass lesion in segment VII/VIII showing peripheral wall enhancement on arterial phase (A) which becomes isointense to liver parenchyma on venous phase (B). Patchy centripetal enhancement is seen in delayed phase (C).

2. PERIDUCTAL INFILTRATING TYPE

This is the most common type in hilar cholangiocarcinoma. This type of cholangiocarcinoma demonstrates growth along a bile duct of abnormal caliber [dilated or narrowed] with no evidence of mass formation.

CT and MR Imaging:

Abnormal diameter of bile duct based on the location of the growth. It may be dilated or abnormally reduced in lumen size. Ductal dilatation may be noted in the periphery. Diffuse thickening in periductal region is noted which shows enhancement on contrast imaging.



Fig 2: Periductal infiltrating type (Klatskin tumour): CECT abdomen coronal and axial images shows circumferential wall thickening with irregular contrast enhancement in common hepatic duct extending to the proximal portion of the common bile duct (arrow) (A and B)with bilateral moderate intrahepatic biliary radicles dilatation. MRCP image of another patient shows absent signal intensity at the confluence of right and left hepatic duct and extending up to the proximal common hepatic duct (C).

3. INTRADUCTAL TYPE

This subtype of cholangiocarcinoma has a non-specific presentation compared to the others. Imaging findings are variable with various as mentioned below:

- Diffuse and marked ductal dilation A) With a visible papillary/polypoidal mass. B) Without a visible Intraductal mass.

- Localized ductal dilatation A) Due to an Intraductal mass. B) Due to focal lesion acting as stricture

- Mildly dilated duct with Intraductal cast like lesions.



Fig 3: Intra-ductal type: MRI T2 HASTE Coronal and axial sections shows heterogeneously hypo-intenselesion in the distal CBD extending to the ampulla of Vater and presenting as a polypoidal mass in the secondpartofduodenum(A)and(B)

MIMICS OF CHOLANGIOCARCINOMA:

The conditions studied in this article which share a close resemblance with the imaging appearance of cholangiocarcinoma are:

Non-neoplastic	conditions	mimicking
cholangiocarcinoma		

- Cholangitis
- HIV cholangiopathy
- Hepatic tuberculosis

Neoplastic conditions mimicking cholangiocarcinoma

- Hepatocellular carcinoma
- Gall bladder carcinoma
- Metastasis

Cholangitis:

Primary sclerosing cholangitis (PSC) is an idiopathic, chronic cholestatic disease with most

age of presentation being fourth or fifth decade and it shows slight male predominance. Its aetiology is unknown, but an autoimmune cause has been strongly suspected. Diffuse inflammation along with progressive fibrosis of the extra-and intrahepatic bile ducts is a characteristic finding ^{(9).}

MRCP imaging shows development of multifocal strictures causing focal dilatation or irregular beading of ducts. Wall thickening of the bile ducts may also be noted. This poses special difficulty in distinguishing it from periductal infiltrating type in cases of localized disease acting as a short-segment stricture.

The most serious complication of primary sclerosing cholangitis is cholangiocarcinoma, the burden of cholangiocarcinoma due to primary sclerosing cholangitis being 0.6%–1.5% cases per year [mostly in first two years of diagnosis of primary sclerosing cholangitis] ⁽¹⁰⁾. Imaging findings in cases of rising suspicion of evolving cholangiocarcinoma are presence of a focal mass or wall thickening of more than 4mm involving the bile ducts.

Similar radiological picture may also be seen in condition such as Recurrent Pyogenic Cholangitis, xantho granulomatous cholangitis and IgG4-related sclerosing cholangitis ⁽¹¹⁾. Concurrent infestation with liver flukes and imaging modalities showing presence of Intraductal pigmented gallstones along with wall thickening and stricture are suggestive of recurrent pyogenic cholangitis. Here, the primary cause of cholangiocyte injury might prove helpful in making diagnosis against cholangiocarcinoma although not entirely ruling out its possibility.

IgG4-related sclerosing cholangitis most commonly involves bile ducts after pancreas as it is usually seen with autoimmune pancreatitis (AIP). However, exclusive biliary involvement may also be present in absence of any obvious pancreatic abnormality, most commonly involving distal intra-pancreatic portion of the common bile duct ^(12,13,14). The imaging features may include wall irregularity or thickening causing luminal stenosis and show contrast enhancement.



Fig 4: Cholangitis: MRI T2W HASTE Coronal (A) and Fat suppressed Axial (B) shows patchy hyperintensity in the segment IV A and VIII around the biliary tree (A and B). Increased periportal T2W hyperintensity bilaterally with mild bilateral intrahepatic biliary duct dilatation is also seen (C).

HIV cholangiopathy

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AIDS cholangiopathy is a rare form of sclerosing cholangitis that classically happens in patients with progressive stages of AIDS ^(15,16). HAART therapy has dramatically decreased its prevalence. Person with CD4 counts of less than 135/mm³ are mostly affected with this condition. The aetiology of HIV cholangiopathy has been attributed to numerous opportunistic pathogens like CMV [cytomegalovirus], HSV, Cryptosporidium parvum, and Mycobacterium avium complex ^(15,16). Although half of the patients have shown no definitive

pathogen as a causative agent. Abdominal pain has been found to be the most common complaint in this subgroup of patients.

Radiological appearances are variable and depends on the degree of inflammation of biliary mucosa. MRI typically shows alternating appearance of normal ducts, duct strictures and dilated ducts typically described as 'beaded appearance'. Edema along the affected intrahepatic ducts with mural enhancement is also seen ^(15,17).



Fig 5: HIV cholangiopathy: MRI T2 HASTE Coronal (A) and Axial (B) sequences show beaded appearance of the intrahepatic bile ducts (arrow). There is short segment stricture at the distal end of CBD at the pancreatic head level causing marked dilatation of CBD and cystic duct with moderate dilatation of the intra hepatic bile ducts.

Hepatic tuberculosis

Hepatic TB is not a common finding as the liver, due to its low oxygen tension is unfavourable for mycobacterial growth. Moreover, it has a nonspecific clinical picture as well as imaging findings. The clinical presentation is similar to pulmonary TB with fever, weight loss being the main symptoms along with additional findings including abdominal pain and hepatomegaly.

It is quite difficult to differentiate primary hepatic TB from intrahepatic Cholangiocarcinoma using only imaging modalities.

On CT it may present with a central, hypo attenuating lesion due to caseating necrosis. A peripheral rim may be seen which shows enhancement on contrast imaging which may be attributed to the adjacent granulation tissue ^[19]. On MRI, low signal intensities

are noted on T1WI, T2WI shows a nodule of variable intensity with a relatively hypo intense rim.

Radiological features of hepatic TB can show lesions with density which can vary according to its different pathologic stages like TB granuloma followed by liquefactive necrosis and advanced stages manifesting as fibrosis or calcification ^[20,21].

In our study, we found two cases where the radiological findings were suggestive of cholangiocarcinoma with both cases having multiple enlarged lymph nodes mainly involving the periportal as well as paraaortic regions. CT guided biopsy of the nodes were done for both patients for further analysis and setting the course of treatment and demonstrated presence of caseating granulomas. Similar features were also seen as an isolated histological finding in a study done by Frank et al⁽¹⁹⁾.



Fig 6: Hepatic tuberculosis: MRI T2W HASTE Coronal (A, C) and Axial (B) sequences shows multiple small diffusely scattered focal hyperintensities in both the lobes of liver. Wall edema with pericholecystic fluid around the gall bladder is seen with multiple peri-hepatic and para-aortic lymph nodes. CT guided biopsy of the lymph nodes showed evidence of tuberculosis infection.

Hepatocellular carcinoma

Hepatocellular carcinoma or HCC is the most common primary neoplasm of hepatobiliary region. In some cases, the local spread of tumour may lead to biliary ductal invasion or intraductal growth ⁽²²⁾.

On imaging intra-biliary involvement is seen as expansile soft-tissue mass causing ductal ectasia ⁽²³⁾. However, this type of presentation is relatively less common but, in such cases, preoperative diagnosis becomes exceedingly difficult due to the lack of any specific imaging findings. Contrast enhancement pattern may be the key in differential diagnosis of HCC and Intrahepatic cholangiocarcinoma owing to the blood supply of primary hepatocyte tumours by hepatic arteries. The intrahepatic cholangiocarcinoma show hypo vascularity in the initial hepatic arterial phase and thus remaining centrally hypo attenuating while showing enhancement in delayed phases due to desmoplastic nature ^(24,25,26).

The presence of risk factors like history of Hepatitis B or C infection or raised serum levels of Alphafetoprotein indicate a possibility of cirrhotic liver which is itself an important predisposition for HCC.



Fig 7: Hepatocellular carcinoma: CECT abdomen Axial sections (A and B) – An ill-defined lesion in segment IVA and IVB shows patchy enhancement in the late arterial phase (A) and washout in the venous phase (B). The lesion is exerting mass effect on the left biliary system causing dilatation of left intrahepatic biliary radicles.



Fig 8: Hepatocellular carcinoma: MRI T2W HASTE (A) and T2W BLADE (B) sequences show multiple T2W hyperintense heterogeneous solid lesion with no internal septations in both lobes of liver. The lesion is seen causing mass effect on adjacent biliary radicles causing dilatation of bilateral intrahepatic biliary radicles.



(A)

(B)

Fig 9: Hepatocellular carcinoma : MRCP 3D Coronal sequence (A and B) shows lesions in both lobes causing mass effect leading to dilatation of bilateral intrahepatic biliary radicles.

Gall bladder carcinoma

GB carcinoma is seen to present in three patterns:

- 1. Mass occupying or replacing the gall bladder
- 2. Focal or Diffuse Asymmetric Wall Thickening
- 3. Intraluminal polyp

On unenhanced CT - 40% of lesions show the first pattern and appear as a hypodense mass with enhancing foci on IV contrast hypervascular administration ^[27,28]. This may prove helpful in differentiating it from other similar mass-forming Intrahepatic neoplasms like HCC or gallbladder Cholangiocarcinoma. On MRI, carcinoma shows variable signal intensity ranging from hypo- to isointense on T1W while moderately hyperintense on T2W sequences ^[29].

On contrast-enhanced CT and MRI, marked, irregular, asymmetric thickening with extensive enhancement during the arterial phase which might stay the same or turn isodense or isointense to the hepatic parenchyma in the portal venous phase is seen ^[28,29].

In 15–25% of cases, it may be seen as polypoidal growth within the lumen which makes it difficult to distinguish from cholangiocarcinoma and other non-neoplastic conditions as well.

Conventional cross-sectional imaging however has proven to be of limited use in making this diagnosis and histopathology is usually necessary.

Metastasis

Tumours that metastasize to the bile ducts may have their origin from the lung, gallbladder, colon, breast,

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prostate and pancreas. Melanoma and lymphoma metastasis have also been known to occur to bile ducts. However, intra biliary metastases are exceedingly rare entity; colorectal carcinoma is known to be the most common primary neoplasm.

Metastases with intra biliary growth can mimic all the morphologic forms of Cholangiocarcinoma radiologically without any effective difference in imaging features ^(30,31). In such cases, clinical history and histological findings may prove to be helpful.

Growth pattern needs to be identified on imaging to find out the extension of the growth and prevent any recurrences. Biliary invasion by colorectal liver metastasis is seen to mimic primary biliary neoplasm as seen in the case report by Serdio et al ⁽³²⁾.



Fig 10: Metastasis: Axial images of CECT abdomen (A) and (B) - Shows an ill-defined hyperdense lesion in the left lobe of liver with enhancement in the venous phase (A). Another ill-defined hypodense lesion in the segment IVA shows patchy enhancement in the venous phase (B).



Fig 11: Metastasis: Axial images of CECT Abdomen (A) and (B) - Small hypodense lesion with ring enhancement is seen in late arterial phase located in segment VIII of right lobe (A). Another lesion in segment VII of right lobe is seen which appears hypodense with no enhancement in the delayed phase (B).

5. CONCLUSION:

A wide spectrum of infective and neoplastic pathologies of biliary system tends to mimic cholangiocarcinoma. Therefore, it is very essential to not only identify the characteristic radiological features of cholangiocarcinoma, but also plan for further assessment in indeterminate cases where imaging interpretation may be difficult. Such cases may need a biopsy to make a definitive diagnosis and to decide further treatment.

REFERENCES:

- 1. Kim NR, Kim SH, Lee JM et al. Enhancement characteristics of cholangiocarcinoma on multiphasic helical CT: emphasis on morphological subtypes. Clinical Imaging 2008;32:114-20.
- 2. Hennedige TP, Venkatesh SK, Neo WT, . Imaging of malignancies of the biliary tractan update. Cancer Imaging 2014;14:14.
- 3. Blechacz BR, Gores GJ. Cholangiocarcinoma. Clinical Liver Diseases 2008;12:131-50. ix.
- 4. Poultsides GA, Choti MA, Zhu AX et al. Intrahepatic cholangio-carcinoma. Surgical Clin North Am 2010;90:817-37.
- Dohan A, Faraoun SA, Barral M, et al. Extraintestinal malignancies in inflammatory bowel diseases: An update with emphasis on MDCT and MRI imaging features. Diagnostic Interventional Imaging 2015;96:871-83.
- 6. Bader TR, Reinhold C, Semelka RC, editors. MRI abdomen-pelvis. New York: Wiley-Liss. Gallbladder and biliary system 2002:319-72.
- Jiang L, Panje CM, Tan-H et al. Role of 18F-FDG PET/CT Imaging in Intra-hepatic Cholangio-carcinoma. Clinical Nuclear Medicine 2016;41:1-7.
- Yamasaki S. Intra-hepatic cholangiocarcinoma: Macroscopic types and classification. J Hepatobiliary Pancreatic Surgery 2003;10:288–291.
- 9. LaRusso NF, Black D, Shneider BL et al. Primary sclerosing cholangitis: Summary of a workshop.Hepatology 2006;44:746–764.
- Burak K, Pasha TM, Angulo P, Petz J, Lindor KD, Egan K. Incidence and risk factors of cholangio-carcinoma in primary sclerosing cholangitis cases. AmJ Gastroenterol 2004;99:523–526.
- 11. Karaosmanoglu, A.D, Karcaaltincaba, Uysal. *etal.* Non-neoplastic hepato-pancreato-biliary lesions simulating malignancy: can we

differentiate?.*Insights Imaging***11**, 21 (2020). https://doi.org/10.1186/s13244-019-0813-8

- 12. Vlachou PA, Khalili K, Fischer S, Jang HJ, Hirschfield GM, Kim TK (2011) IgG4-related sclerosing diseases: Autoimmune pancreatitis and extra-pancreatic manifestations. Radiographics 31(5):1379–1402
- 13. Hedgire SS, Borczuk D, ,McDermott S ,Saini S, Harisinghani MG ,Elmi A (2013) The spectrum of IgG4-related diseases in the abdomen and pelvis. AJR 201(1):14–22
- 14. Martínez-de-Alegría A, García-Figueiras R ,Baleato-González S et al (2015) IgG4-related diseases from head to toe. Radio-graphics 35(7):2007–2025
- 15. Abdalian R, Heathcote EJ. Sclerosing cholangitis : A focus on secondary causes. Hepatology 2006;44:1063–1074.
- 16. Keaveny AP, Karasik MS. Hepato-biliary and pancreatic infections in AIDS: Part II. AIDS Patient Care STDS 1998;12:451–456.
- 17. Dolmatch BL, Ferderle MP, Laing FC Jeffrey RB, Cello J. AIDS-related cholangitis : Radiographic findings in nine patients. Radiology 1987;163: 313–316.
- Cello JP, Chan MF. Long-term follow-up of ERCP sphincterotomy for patients with AIDS related papillary stenosis. Am J Med 1995;99:600–603.
- 19. Park, Jeong-Ik. "Primary hepatic TB mimicking intra-hepatic cholangiocarcinoma: Report of two cases." Annals of surgical treatment and research vol. 89,2 (2015): 98-101. doi:10.4174/astr.2015.89.2.98
- 20. Wu Z, Wang WL, Cheng JW, Dong J, Zhu Y, Li MX, et al. Diagnosis and treatment of hepatic TB: report of five cases and review of literature. Int J ClinExp Med. 2013;6:845– 850.
- 21. Hersch C. Tuberculosis of the liver: A study of 200 cases. S Afr Med J. 1964;38:857–863.
- 22. Leong JW, Ho JM, Raj JP, Ng HS. Early hepatocellular carcinoma presenting with biliary duct invasion: a case report. Ann Acad Med Singapore 2000;29:101–104.

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- 23. Qin LX, Tang ZY. Hepatocellular carcinoma with obstructive jaundice: diagnosis, treatment and prognosis. World J Gastroenterology 2003;9:385–391.T
- 24. Tada H, Morimoto M, Shima T et al. Progressive jaundice due to lymphangiticcarcinomatosa of the liver: CT appearance. J Comput Assist Tomogr 1996;20:650-2.
- Lim JH, Park CK. Pathology of cholangiocarcinoma. Abdominal Imaging 2004;29:540-7.
- 26. Kawakatsu M, Vilgrain V, Zins M, et al. Radiologic features of papillary adenoma and papillomatosis of the biliary tract. Abdominal Imaging 1997;22:87-90.
- 27. Franquet T,Jimenez FJ Montes M, Ruiz de Azua Y, Cozcolluela R. Primary gallbladder carcinoma: imaging findings in 50 patients with pathological correlation. *GastrointestRadiol*1991; 16:143–148

- 28. Yun EJ, Cho SG, Park S, et al. Gallbladder cancer and chronic cholecystitis: differentiation with two phase spiral CT. *Abdominal Imaging* 2004; 29:102–108
- 29. Yun EJ, Cho SG, Park S, et al. Gallbladder cancer and chronic cholecystitis: differentiation with two phase spiral CT. *Abdominal Imaging* 2004; 29:102–108
- 30. Leong JW, Ho JM, Ng HS, Raj JP. Early hepatocellular carcinoma presenting with biliary duct invasion: a case report. Ann Acad Med Singapore 2000;29:101–104.
- Qin LX, Tang ZY. Hepatocellular carcinoma with obstructive jaundice: diagnosis, treatment and prognosis. World J Gastroenterol 2003;9:385–391.
- Intrabiliary metastasis of colorectal carcinoma: review of intraductal growth-type pattern; M. LETURIA ETXEBERRIA, A. Serdio et al; ECR 2020 / C-04145.