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Standardized Reporting of Extrahepatic Cholangiocarcinoma

Abstract

Cholangiocarcinoma, a primary epithelial malignancy originating in the biliary tree, can be classified based on anatomical location into intrahepatic and extrahepatic cholangiocarcinoma. Extrahepatic cholangiocarcinoma (eCCA) is the more common of the two. CT and MRI play a central role in the diagnosis, staging, and management of eCCA, yet radiological reporting of eCCA often lacks uniformity and completeness which can hamper optimal treatment decision-making. Standardized reporting including standardized terminology and structured reports can address these shortcomings. Standardization produces clear, concise, and accurate terminology to facilitate communication between radiologists, surgeons, oncologists, pathologists, and interventionalists, which can be particularly important in complex cases where treatment hinges on discerning fine anatomical details. Structured report templates organize reporting elements in ordered sections to ensure consistency and completeness when conveying relevant imaging findings. In this manuscript, we aim to provide guidance on eCCA reporting, discussing the relevance of each proposed reporting element and presenting a recommended and structured eCCA reporting template. The proposed structured report, adapted from the template proposed by the Korean Society of Abdominal Radiology, is tailored particularly to North American clinical practice and addresses additional reporting elements such as background liver information and tumor dimension.

Keywords: extrahepatic cholangiocarcinoma, standardized reporting, structured reporting, standardized terminology, MRI, CT

Introduction

Cholangiocarcinoma (CCA) (also known as “bile duct cancer”) is a primary epithelial malignancy originating in the biliary tree. CCAs can be classified into two types based on anatomical location [1, 2]: (1) intrahepatic cholangiocarcinoma (iCCA), defined as CCA localized to the second-order (or higher) bile ducts leading to its reference as "peripheral cholangiocarcinoma" and its classification as a primary liver malignancy; and (2) extrahepatic cholangiocarcinoma (eCCA), which is defined as CCA arising from the common bile duct, common hepatic duct, primary confluence, right hepatic duct, and/or left hepatic duct. iCCA accounts for 10% of all CCAs and is the second most common primary liver malignancy after hepatocellular carcinoma. Meanwhile, eCCA can be further divided based on anatomical location into perihilar cholangiocarcinoma (pCCA) and distal cholangiocarcinoma (dCCA). pCCA is defined as tumor originating from the biliary tree, proximal to the cystic duct insertion, whereas dCCA is defined as tumor originating distal to the cystic duct insertion [3, 4]. These account for 70% and 20% of all CCAs, respectively.

The characterization and reporting of CCA at imaging can be complex, especially in the case of pCCAs that straddle the boundary between intrahepatic and extrahepatic ducts. Nevertheless, optimal characterization and reporting is crucial for treatment planning, particularly surgical planning. iCCA is often managed through hepatectomy, while dCCA may necessitate pancreaticoduodenectomy, and pCCA may require resection of the bile duct confluence or resection of portions of the liver [3, 5]. Recently, the Society of Abdominal Radiology (SAR) Cholangiocarcinoma Disease-Focused Panel (DFP) introduced a standardized lexicon for CCA [6] as well as a structured reporting template for iCCA [7]. In this manuscript, we aim to provide guidance on eCCA reporting, discussing the relevance of each proposed reporting element and presenting a recommended and structured eCCA reporting template. The proposed structured report, adapted from the template proposed by the Korean Society of Abdominal Radiology (KSAR) [8]r information and radial dimension.

Need for structured reporting

The aim of standardized terminology is to provide clear, concise, and accurate reporting of disease status at imaging to all members of the clinical team, including physicians of different specialties, nurses, pharmacists, and social workers [9]. Along with standardized terminology, structured reporting by way of a uniform template is critical to provide consistent and complete information and has been introduced successfully for several cancer types (such as pancreatic, rectal, and prostate cancer) [10-13]. Structured reporting offers a better chance at consistency and completeness at both intra- and inter-institutional levels. Structured reporting avoids narrative text or “free-text reports” that potentially bury or omit important information; hence, it reduces ambiguity in disease staging and management planning [14, 15].

For eCCA, structured reporting plays a crucial role in providing comprehensive details regarding aspects of the tumor that are essential for surgical planning as well as for eligibility for liver transplant. A standardized template that prompts radiologists to provide complete details regarding vascular and bile duct involvement better enables the surgeons to assess the optimal resection approach and the necessary biliary and/or vascular reconstruction for curative treatment. When combined with patient factors and an estimate of future liver remnant volume, the surgeon can make a more straightforward decision regarding the feasibility of surgical resection. In most cases where surgical resection is not possible, management typically involves chemotherapy and/or radiation followed by transplant in eligible patients [16]. Structured reporting also enhances long-term disease monitoring, helping to identify new sites of involvement requiring endoscopic or percutaneous management [17-19]. Historically, the rarity and complex behavior of eCCA in addition to inconsistent reporting has hampered the ability of physicians to design high-quality studies and precise risk stratification for treatment planning. By standardizing data collection, structured reporting can improve clinical trial enrollment and enable large-scale analysis to determine the key features of eCCA impacting clinical outcomes [20, 21].

Role of radiologists in providing information for surgical planning

The surgical resectability of eCCA is determined based on multiple factors, such as technical feasibility, tumor extent and stage, and the patient's clinical health [22]. Patients are stratified into three categories: (1) potentially resectable, where surgery is a direct option; (2) borderline resectable, where curative surgery may be feasible following neoadjuvant therapy; and (3) unresectable, where surgery is not feasible. Radiologists play a key role in the assessment of surgical resectability by providing crucial information such as tumor extent and anatomy. In the case of pCCA with its higher surgical risk of increased morbidity and mortality, this information occupies a large role in clinical management decisions [23].

The American Joint Committee on Cancer TNM staging system [24] is used routinely in staging. It evaluates three key factors: T stage, based on the depth of invasion of the tumor (radial or vertical); N stage, determined by the number of regional lymph node metastases; and M stage indicating the presence of distant metastatic disease. For pCCA , the T stage is classified as follows: T1: Tumor confined within the bile duct; T2: Tumor extends beyond the bile duct wall or into the adjacent hepatic parenchyma; T3: Tumor involves unilateral branches of the portal vein or hepatic artery; and T4: Tumor invades the main portal vein or its bilateral branches, the common hepatic artery, or the unilateral second-order biliary ducts in combination with contralateral vascular (portal vein or hepatic artery) involvement. Despite its widespread use, the TNM staging system does not account for longitudinal tumor extent which often determines the surgical resectability of

pCCA. Ultimately, this shortcoming can affect the utility of TNM staging in the preoperative setting compared to the postoperative setting [25].

The modified Bismuth–Corlette system [26] is widely used for the classification of pCCA to aid in surgical planning (**Figure 1**). This system classifies pCCA into four distinct types: type I: tumor only involving the common hepatic duct below the hilar confluence (**Figure 2**); type II: tumor extending to the hilar confluence without extending to the secondary ductal confluence. (**Figure 3**); type III: tumor extending to either right (type IIIa) or left (type IIIb) secondary ductal confluence (**Figures 4 and 5**); and type IV: tumor involves both right and left secondary ductal confluence (**Figure 6**). Types I and II are usually amenable to surgical resection, type III may require extended hepatectomy, and type IV has traditionally been considered unresectable. This classification does not take into consideration anatomical biliary variants, vascular involvement, or the presence of lobar atrophy; therefore, it is often insufficient as a standalone tool for preoperative staging and surgical planning.

The Memorial Sloan Kettering Cancer Center presurgical T-staging system [27-29] was developed to aid the presurgical planning of pCCA and to incorporate additional anatomic criteria for unresectability, which includes: tumor extension into bilateral secondary biliary radicles, encasement or occlusion of the main portal vein proximal to its bifurcation, unilateral hepatic lobar atrophy with contralateral portal vein branch encasement or occlusion, unilateral atrophy with contralateral extension into segmental bile ducts (secondary biliary radicles), and unilateral secondary biliary extension with contralateral portal vein involvement. Limitations of this system include the non-quantitative and subjective assessment of lobar atrophy as well as the lack of assessment of hepatic artery involvement. Furthermore, with advances in hepatobiliary surgical techniques, particularly those enabling vascular reconstruction, the criteria for extended resections continue to evolve. As a result, many tumors previously classified as T3 and considered unresectable are now deemed operable, reducing the contemporary applicability of this staging system [25].

Other criteria for the unresectability of pCCA have been proposed by Lee et al. [30] which include: (1) bilateral secondary biliary confluence involvement with tumor extension beyond 2 cm from the hilum (2) invasion of the main portal vein or proper hepatic artery over a length greater than 2 cm (3) atrophy of one hepatic lobe with associated contralateral vascular or secondary confluence invasion, (4) tumor extension into secondary confluence in one lobe and concurrent contralateral vascular invasion.

More recently, the KSAR [8] published a consensus guideline for preoperative CT and MR imaging evaluation of eCCA, including both pCCA and dCCA. According to this guideline, imaging evaluation should include assessing the longitudinal extent of biliary ductal involvement, the presence or absence in addition to degree of vascular involvement of the portal vein and hepatic artery, and the presence of regional metastatic lymphadenopathy and distant metastases. In addition, the guideline highlighted the importance of accurate

estimation of the future liver remnant volume using CT or MRI as a determining factor for the feasibility and safety of surgical resection.

Beyond resection, radiologists play an important role in other surgical strategies, particularly by helping to determine eligibility for liver transplantation. In patients with primary sclerosing cholangitis and/or unresectable pCCA, liver transplantation in combination with neoadjuvant therapy may be potentially curative. According to the American Association for the Study of Liver Diseases (AASLD) guidelines [16], transplantation is recommended for patients with pCCA measuring ≤ 3 cm in radial diameter and without evidence of intrahepatic or extrahepatic metastases and who have completed a standardized neoadjuvant regimen. Similarly, the European Association for the Study of the Liver (EASL) [31], in conjunction with the International Liver Cancer Association (ILCA), endorses transplantation for patients with locally advanced, unresectable pCCA ≤ 3 cm in size and with no distant metastases, provided that treatment is performed in experienced centers using established neoadjuvant protocols.

Proposed structured reporting

Cross-sectional imaging, namely CT and MRI, is central for the staging and the management of eCCA. We propose a structured report template for cross-sectional imaging of eCCA **Table 1**). The template was developed through iterative discussions among 15 radiologists from the SAR Cholangiocarcinoma DFP, representing 12 institutions across the United States and Canada. All participants had expertise in eCCA preoperative staging and transplant imaging. Informed by the KSAR guideline [8], our discussions also incorporated relevant published literature, institutional protocols from high-volume transplant and oncology centers, and expert consensus on imaging features essential for surgical planning and transplant eligibility. This collaborative process ensured that the final template was tailored to North American clinical practice and expanded upon the KSAR guideline by introducing new reporting elements such as background liver information and radial dimension.

Figures 2–6 provide examples of eCCA described based on this template. Below, we discuss the relevance of each individual reporting element.

Image quality

Similar to the SAR's template for iCCA [7], image quality should be reported. Common causes of poor examination quality or adequacy for diagnosis include image degradation from artifacts related to motion or metallic material, poor timing of contrast administration, low signal-to-noise ratio due to body habitus, and ascites generating dielectric effect on MRI [32]. Alternative imaging modalities should also be suggested if needed. We suggest the use of an adequacy score:

- *No or minimal* – Imaging is adequate for tumor assessment.
- *Moderate* – Imaging has limitations but is acceptable for tumor assessment.
- *Severe* – Imaging is inadequate for tumor assessment. (Alternative imaging should be recommended.)

Background liver information

Background liver characteristics can impact both patient prognosis and management planning. Advanced forms of diffuse liver disease, such as severe steatosis or features of end-stage fibrosis, as well as the presence of segmental atrophy or hypertrophy, should be included in the report as these may impact prognosis when considering future liver remnant functional status, and hence, the surgical technique. Although not addressed in the KSAR guideline, we added it to our proposed reporting structure due to its importance.

Tumor location: Perihilar versus distal

At presentation, treatment and natural history differ between pCCA and dCCA, and the identification of the tumor location is imperative [33, 34]. pCCA is defined as CCA arising proximal to the cystic duct insertion [35], while dCCA is defined as CCA arising in the common bile duct and distal to the cystic duct insertion.

Gross morphology

eCCA can be classified morphologically as mass-forming, periductal-infiltrating, and intraductal-growing [36].

Although imaging data specific to mass-forming extrahepatic cholangiocarcinoma are lacking, its enhancement pattern is presumed to resemble that of intrahepatic mass-forming cholangiocarcinoma due to similar histopathologic features. Mass-forming eCCA (**Figures 4 and 6**) is characterized by a heterogeneous, non-encapsulated mass on imaging. There are no published data about the imaging characteristics of mass-forming eCCA [6, 37]. The bile ducts upstream of the mass may demonstrate intraductal tumor growth which can impact biliary drainage.

Periductal-infiltrating eCCA (**Figures 3 and 5**) has a growth pattern characterized by soft tissue growing along the bile duct wall without forming a mass. On imaging, it is identified by periductal wall thickening, resulting in narrowing or occlusion of the duct. It can appear irregular and ill defined. Periductal-infiltrating eCCA enhances most avidly on delayed phase imaging and is associated with biliary dilation upstream of the tumor. Diffusion-weighted imaging may be helpful in some cases. This is the most common form of eCCA, accounting for up to 70% cases [6].

Intraductal-growing eCCA (**Figure 2**) occurs within the bile duct lumen. On imaging, diffuse duct ectasia is typically seen without a visible mass [38]. When a mass is visible, it may present as an intraductal polypoid mass, a cast-like biliary lesion, or a focal biliary

stricture. In some cases, a filling defect can be identified on magnetic resonance cholangiopancreatography, or an enhancing tumor may be identified on the venous and delayed phases post contrast administration. Diffusion restriction can often aid in the diagnosis of an otherwise occult intraductal-growing CCA [6]. In our clinical experience and when a hepatobiliary agent is used, intraductal eCCA can be seen as a filling defect within the biliary tree.

Evaluation of mass-forming, periductal-infiltrating, or intraductal-growing eCCA should include accurate tumor measurements, including the longitudinal extent from the proximal to distal portions of ductal involvement, which is an important criterion for surgical resection. We recommend measuring the longitudinal extent on coronal or sagittal images, using the longest dimension and preferably in centimeters. For ill-defined tumors with challenging border delineation, all available imaging planes and sequences should be used to improve measurement accuracy. Also, while not included in the KSAR guideline, radial thickness of the involved bile duct or associated mass should be measured and reported in centimeters, defined as the maximum axial thickness of the tumor including the mass-forming component. This measurement is clinically relevant as radial tumor diameter < 3 cm is a key eligibility criterion for liver transplantation in select patients. Examples of longitudinal and radial measurements are given in **Figure 5**. The location and accurate assessment of the ductal segments involved should be included. The degree and extent of upstream biliary dilation involving both the intrahepatic and extrahepatic ducts should also be included. The presence and extent of parenchymal liver invasion, lobar atrophy, and adjacent visceral involvement are essential to include to better assess resectability [39].

Biliary intervention

The only curative treatment for both pCCA and dCCA is surgical resection with negative margins [40]. Multiple biliary interventions also exist to improve the quality of life for patients with unresectable pCCA or dCCA or to provide palliative care by relieving the blocked common bile duct. These biliary interventions include biliary bypass, endoscopic stent placement, and percutaneous transhepatic biliary drainage [41]. Documenting the specific biliary intervention offers valuable insight into the patient's overall management and may clarify atypical imaging findings.

Bile duct evaluation

Evaluation of the common bile duct, including degree of stenosis or obstruction, and a description of anatomic variants should also be reported.

Anatomical variants of the common bile duct should be noted for surgical planning, including low insertion of the cystic duct, insertion of the cystic duct into the right hepatic duct, and an abnormal pancreaticobiliary junction (a rare condition when the common bile duct and pancreatic duct join outside of the duodenum and form an abnormally long channel [42]). Involvement of the cystic duct should be explicitly mentioned in the report.

It is an indication for a Whipple procedure with its increased risk of distal common bile duct recurrence.

[43].

Vascular supply and variant

Vessel evaluation should be performed based on multi-phase cross-sectional imaging, with arterial anatomy evaluated on the arterial phase and venous anatomy evaluated on the portal venous phase. Anatomic variants should be identified and characterized for surgical planning. These include the presence of a replaced hepatic artery from the superior mesenteric artery, a hepatic artery arising from the aorta, variants of the common hepatic artery, or accessory arteries. While venous variants of the portal venous system and hepatic veins may be less likely to impact surgical planning, they should also be reported.

Tumoral vascular invasion

Hepatic arteries and branches as well as portal veins should be examined and reported for tumor contact, abutment, encasement, and thrombosis. Venous involvement, including involvement of the main portal vein or left/right branches, should also be reported. The hepatic veins and inferior vena cava should be examined for their location in relation to the tumor and described when in proximity, e.g., if the inferior vena cava lies superior to the tumor. Lastly, venous outflow obstruction secondary to mass effect should be reported [18, 39]. Abutment is defined as ≤ 50% involvement of the vessel circumference (i.e., ≤ 180° of vessel wall involvement). Encasement is defined as > 50% involvement of the vessel circumference (i.e. > 180° of vessel wall involvement) or presence of vessel deformity, occlusion, or tumor thrombus [8]. **Figures 4, 5, and 6** show examples of vascular abutment and encasement.

Regional lymph node metastasis

Key regional nodal stations for the evaluation of eCCA resectability include: pericholedochal, hilar, peripancreatic, celiac, and superior mesenteric nodes. For eCCA, the criteria for positive lymph nodes are generally based on size and imaging characteristics rather than a strict 1 cm threshold. According to staging guidelines, lymph nodes measuring > 10 mm in the short axis, or ≤ 10 mm but showing central necrosis, are considered positive. Other suspicious features include loss of the fatty hilum, clustering, and the presence of nodal enhancement compared to the background liver parenchyma on the portal venous phase [30, 44]. The presence of these regional lymph nodes indicates N1 disease. The presence of more distal suspicious lymph nodes is classified as M1 disease.

Distant metastasis

A thorough evaluation of the abdomen, pelvis, bones, and lungs is essential for adequate staging and treatment decision-making. The liver is a common site of distant metastasis from eCCA. Liver metastases from eCCA typically present as parenchymal nodules and less frequently as biliary satellite deposits. The volume and multifocality of such liver metastases should be reported. In addition to assessing the abdomen for liver metastasis, the abdomen and pelvis should be assessed for peritoneal nodularity, omental caking, serosal implants, and ascites. Adrenal metastases are less common than liver metastases; however, a new adrenal nodule should still raise suspicion. Direct tumor involvement of the gallbladder, pancreas, and duodenum should be reported. New or growing lung nodules, pleural effusions, and lymphangitic spread are all examples of thoracic metastases. Bone metastases may be lytic or sclerotic, and any new bone lesion on imaging warrants detailed discussion. In challenging cases, PET/CT can be useful for the detection of distant eCCA metastases.

Conclusion

Our proposed structured reporting template for extrahepatic cholangiocarcinoma was designed to guide radiologists to assist in generating complete reports which include all the pertinent findings needed for decision-making. Combining the template with the recently published cholangiocarcinoma lexicon will further provide easily interpretable, uniform information important to the clinical team and facilitate communication and treatment strategies. Given that this template has not yet undergone external validation, future studies are warranted to assess its reproducibility, inter-reader agreement, and clinical utility through structured methodologies such as the Delphi method and prospective multicenter testing.

References

1. Khan SA, Tavolari S, Brandi GJLI. Cholangiocarcinoma: Epidemiology and risk factors. 2019;39:19-31.
2. Chung T, Park YN. Up-to-Date Pathologic Classification and Molecular Characteristics of Intrahepatic Cholangiocarcinoma. Frontiers in medicine. 2022;9:857140. doi: 10.3389/fmed.2022.857140.
3. Joo I, Lee JM, Yoon JH. Imaging Diagnosis of Intrahepatic and Perihilar Cholangiocarcinoma: Recent Advances and Challenges. Radiology. 2018;288(1):7-13. doi: 10.1148/radiol.2018171187.
4. World Health Organization. Digestive System Tumours. 5th ed. Lyon, France: International Agency for Research on Cancer; 2019.
5. Tzedakis S, Sindayigaya R, Dhote A, Marchese U, Barret M, Belle A, et al. Perihilar cholangiocarcinoma: What the radiologist needs to know. Diagn Interv Imaging. 2022;103(6):288-301. doi: 10.1016/j.diii.2022.03.001.
6. Marks RM, Arif H, Antonietta Bali M, R LB, G MC, Khasawneh H, et al. Standardizing the reporting of cholangiocarcinoma: the society of abdominal radiology disease focused panel on cholangiocarinoma lexicon. Abdom Radiol (NY). 2025. doi: 10.1007/s00261-024-04769-9.
7. Kierans AS, Cunha GM, King MJ, Marks RM, Miller FH, Lee JM, et al. Standardized reporting of intrahepatic cholangiocarcinoma. Abdom Radiol (NY). 2025;50(4):1584-94. doi: 10.1007/s00261-024-04582-4.
8. Lee DH, Kim B, Lee ES, Kim HJ, Min JH, Lee JM, et al. Radiologic Evaluation and Structured Reporting Form for Extrahepatic Bile Duct Cancer: 2019 Consensus Recommendations from the Korean Society of Abdominal Radiology. Korean journal of radiology. 2021;22(1):41-62. doi: 10.3348/kjr.2019.0803.
9. Ohaegbulam KC, Koethe Y, Fung A, Mayo SC, Grossberg AJ, Chen EY, et al. The multidisciplinary management of cholangiocarcinoma. Cancer. 2023;129(2):184-214. doi: 10.1002/cncr.34541.
10. Al-Hawary MM, Francis IR, Chari ST, Fishman EK, Hough DM, Lu DS, et al. Pancreatic ductal adenocarcinoma radiology reporting template: consensus statement of the Society of Abdominal Radiology and the American Pancreatic Association. Radiology. 2014;270(1):248-60. doi: 10.1148/radiol.13131184.
11. Esfahani SA, Morris MJ, Sartor O, Frydenberg M, Fanti S, Calais J, et al. Standardized template for clinical reporting of PSMA PET/CT scans. European journal of nuclear medicine and molecular imaging. 2024;52(1):335-41. doi: 10.1007/s00259-024-06857-w.
12. Spinu-Popa EV, Cioni D, Neri E. Radiology reporting in oncology-oncologists' perspective. Cancer Imaging. 2021;21(1):63. doi: 10.1186/s40644-021-00431-5.
13. Alvfeldt G, Aspelin P, Blomqvist L, Sellberg N. Radiology reporting in rectal cancer using MRI: adherence to national template for structured reporting. Acta radiologica (Stockholm, Sweden : 1987). 2022;63(12):1603-12. doi: 10.1177/02841851211057276.

14. Ganeshan D, Duong PT, Probyn L, Lenchik L, McArthur TA, Retrouvey M, et al. Structured Reporting in Radiology. Academic radiology. 2018;25(1):66-73. doi: 10.1016/j.acra.2017.08.005.
15. Larson DB, Towbin AJ, Pryor RM, Donnelly LF. Improving consistency in radiology reporting through the use of department-wide standardized structured reporting. Radiology. 2013;267(1):240-50. doi: 10.1148/radiol.12121502.
16. Bowlus CL, Arrivé L, Bergquist A, Deneau M, Forman L, Ilyas SI, et al. AASLD practice guidance on primary sclerosing cholangitis and cholangiocarcinoma. 2023;77(2):659-702. doi: 10.1002/hep.32771.
17. Soares KC, Jarnagin WR. The Landmark Series: Hilar Cholangiocarcinoma. Annals of surgical oncology. 2021;28(8):4158-70. doi: 10.1245/s10434-021-09871-6.
18. Esnaola NF, Meyer JE, Karachristos A, Maranki JL, Camp ER, Denlinger CS. Evaluation and management of intrahepatic and extrahepatic cholangiocarcinoma. Cancer. 2016;122(9):1349-69. doi: 10.1002/cncr.29692.
19. Washington K, Rocha F. Approach to Resectable Biliary Cancers. Current treatment options in oncology. 2021;22(11):97. doi: 10.1007/s11864-021-00896-3.
20. Durack JC. The value proposition of structured reporting in interventional radiology. AJR Am J Roentgenol. 2014;203(4):734-8. doi: 10.2214/AJR.14.13112.
21. Lewis PB, Charalel RA, Salei A, Cantos AJ, Dubel GJ, Kassin MT, et al. Challenges, Barriers, and Successes of Standardized Report Templates: Results of a Society of Interventional Radiology Survey. Journal of vascular and interventional radiology : JVIR. 2023;34(12):2218-23 e10. doi: 10.1016/j.jvir.2023.08.020.
22. Sano T, Shimizu Y, Senda Y, Kinoshita T, Nimura Y. Assessing resectability in cholangiocarcinoma. Hepatic oncology. 2014;1(1):39-51. doi: 10.2217/hep.13.6.
23. Nooijen LE, Swijnenburg RJ, Klümpen HJ, Verheij J, Kazemier G, van Gulik TM, et al. Surgical Therapy for Perihilar Cholangiocarcinoma: State of the Art. Visceral medicine. 2021;37(1):18-25. doi: 10.1159/000514032.
24. American Joint Committee on Cancer. AJCC Cancer Staging Manual. 8th ed. Cham: Springer; 2017.
25. Yong YSS, Lee ZR, Soh YTN, Low SCA. Preoperative Imaging Assessment and Staging of Perihilar Cholangiocarcinoma: Tips and Pitfalls. Journal of the Korean Society of Radiology. 2025;86(1):45-67. doi: 10.3348/jksr.2024.0055.
26. Bismuth H, Nakache R, Diamond T. Management strategies in resection for hilar cholangiocarcinoma. Annals of surgery. 1992;215(1):31-8. doi: 10.1097/00000658-199201000-00005.
27. Jarnagin WR, Fong Y, DeMatteo RP, Gonen M, Burke EC, Bodniewicz BJ, et al. Staging, resectability, and outcome in 225 patients with hilar cholangiocarcinoma. Annals of surgery. 2001;234(4):507-17; discussion 17-9. doi: 10.1097/00000658-200110000-00010.
28. LaFemina J, Jarnagin WR. Surgical management of proximal bile duct cancers. Langenbeck's archives of surgery. 2012;397(6):869-79. doi: 10.1007/s00423-012-0928-6.
29. Burke EC, Jarnagin WR, Hochwald SN, Pisters PW, Fong Y, Blumgart LH. Hilar Cholangiocarcinoma: patterns of spread, the importance of hepatic resection for curative

operation, and a presurgical clinical staging system. Annals of surgery. 1998;228(3):385-94. doi: 10.1097/00000658-199809000-00011.
30. Lee HY, Kim SH, Lee JM, Kim SW, Jang JY, Han JK, et al. Preoperative assessment of resectability of hepatic hilar cholangiocarcinoma: combined CT and cholangiography with revised criteria. Radiology. 2006;239(1):113-21. doi: 10.1148/radiol.2383050419.
31. Marzioni M, Maroni L, Aabakken L, Carpino G, Groot Koerkamp B, Heimbach J, et al. EASL Clinical Practice Guidelines on the management of extrahepatic cholangiocarcinoma. Journal of Hepatology. doi: 10.1016/j.jhep.2025.03.007.
32. Hong CW, Cunha GM, Yokoo T, Roudenko A, Kelm ZS, Fung A, et al. Performing liver imaging at a high level: quality and adequacy in LI-RADS. Abdom Radiol (NY). 2025;50(6):2502-11. doi: 10.1007/s00261-024-04679-w.
33. Waseem D, Tushar P. Intrahepatic, perihilar and distal cholangiocarcinoma: Management and outcomes. Annals of hepatology. 2017;16(1):133-9. doi: 10.5604/16652681.1226927.
34. Hang H, Jeong S, Sha M, Kong D, Xi Z, Tong Y, et al. Cholangiocarcinoma: anatomical location-dependent clinical, prognostic, and genetic disparities. Annals of translational medicine. 2019;7(23):744. doi: 10.21037/atm.2019.12.37.
35. Nagino M. Perihilar cholangiocarcinoma: a surgeon's viewpoint on current topics. Journal of gastroenterology. 2012;47(11):1165-76. doi: 10.1007/s00535-012-0628-6.
36. Chung Y, Kim M-J, Park YN, Choi j-y, Pyo J, Kim Y, et al. Varying Appearances of Cholangiocarcinoma: Radiologic-Pathologic Correlation. Radiographics : a review publication of the Radiological Society of North America, Inc. 2009;29:683-700. doi: 10.1148/rg.293085729.
37. Banales JM, Marin JJG, Lamarca A, Rodrigues PM, Khan SA, Roberts LR, et al. Cholangiocarcinoma 2020: the next horizon in mechanisms and management. Nat Rev Gastroenterol Hepatol. 2020;17(9):557-88. doi: 10.1038/s41575-020-0310-z.
38. Lee WJ, Lim HK, Jang KM, Kim SH, Lee SJ, Lim JH, et al. Radiologic spectrum of cholangiocarcinoma: emphasis on unusual manifestations and differential diagnoses. Radiographics. 2001;21 Spec No:S97-s116. doi: 10.1148/radiographics.21.suppl_1.g01oc12s97.
39. Choi B, Lee J. Preoperative imaging. Hilar Cholangiocarcinoma. Springer; 2013. p. 53-64.
40. Gorji L, Beal EW. Surgical Treatment of Distal Cholangiocarcinoma. Current oncology (Toronto, Ont). 2022;29(9):6674-87. doi: 10.3390/curroncol29090524.
41. National Cancer Institute: Bile Duct Cancer Treatment. https://www.cancer.gov/types/liver/bile-duct-cancer/treatment. (2024). Accessed May 23, 2025.
42. Antonios K, Shah N, McGorisk T. Recurrent Acute Pancreatitis in the Setting of Abnormal Pancreaticobiliary Junction. Cureus. 2023;15(10):e47029. doi: 10.7759/cureus.47029.
43. Valero V, 3rd, Cosgrove D, Herman JM, Pawlik TM. Management of perihilar cholangiocarcinoma in the era of multimodal therapy. Expert review of gastroenterology & hepatology. 2012;6(4):481-95. doi: 10.1586/egh.12.20.

44. Mar WA, Shon AM, Lu Y, Yu JH, Berggruen SM, Guzman G, et al. Imaging spectrum of cholangiocarcinoma: role in diagnosis, staging, and posttreatment evaluation. Abdom Radiol (NY). 2016;41(3):553-67. doi: 10.1007/s00261-015-0583-9.

Tables

Table 1 Proposed structured reporting for extrahepatic cholangiocarcinoma

Exam limitation: *No or minimal /Moderate /Severe* Comments (if applicable): Imaging is degraded by [...]. Recommendation: [Repeat imaging, alternate imaging modality, follow up] Background liver information (if applicable) Presence of hepatic lobar atrophy: Yes/No (specify segment) Presence of hepatic lobar hypertrophy: Yes/No (specify segment)
Tumor location: • Perihilar CCA • Distal CCA
Gross morphology (based on dominant component) • Mass-forming • Periductal-infiltrating • Intraductal-growing
Measurements: • Longest longitudinal dimension (cm) • Radial dimension (cm)
Biliary intervention: • Absent • Present: Transhepatic percutaneous drainage Internal drainage Both Presence of biliary intervention affects extent of disease evaluation: Yes/No
Bile duct evaluation: 1. Bile duct involvement: • Right secondary confluence • Left secondary confluence • Right hepatic duct • Left hepatic duct • Primary confluence • Common hepatic duct • Supra-pancreatic common bile duct • Intrapancreatic common bile duct 2. Involvement of the cystic duct: Yes/No 3. If no Involvement of cystic duct: Distance of the tumor from the cystic duct (cm) 4. Distance of the tumor from the biliary confluence (cm) 5. Bile duct anatomy variation: • Not evaluable • Absent

- Present (specify)

6. Bismuth classification
    - Type I
    - Type II
    - Type IIIA
    - Type IIIB
    - Type IV
7. Presence of intrahepatic biliary dilatation: Yes/No (specify segment(s))

Vessel evaluation:

1. Arterial anatomy variation: No/Yes (specify)
2. Portal vein anatomy variation: No/Yes (specify)

Vascular invasion:

1. Artery:
    - Right hepatic artery: No contact/Abutment/Encasement (Invasion)
    - Left hepatic artery: No contact/Abutment/Encasement (Invasion)
    - Proper hepatic artery: No contact/Abutment/Encasement (Invasion)
    - Common hepatic artery: No contact/Abutment/Encasement (Invasion)
    - Celiac trunk: No contact/Abutment/ Encasement (Invasion)
    - Superior mesenteric artery: No contact/Abutment/Encasement (Invasion)
    - Other variant (specify): No contact/Abutment/Encasement (Invasion)
2. Vein:
    - Right portal vein: No contact/Abutment/Encasement (Invasion)
    - Left portal vein: No contact/Abutment/Encasement (Invasion)
    - Main portal vein: No contact/Abutment/Encasement (Invasion)
    - Superior mesenteric vein: No contact/Abutment/Encasement (Invasion)
    - Other variant (specify): No contact/Abutment/Encasement (Invasion)

Tumor invasion of adjacent organs: Yes/No (specify)

Regional lymph node metastasis:

- Absent
- Present
- Indeterminate

Specify location and size

Distant metastasis:

- Absent
- Present: specify location and size

Figures

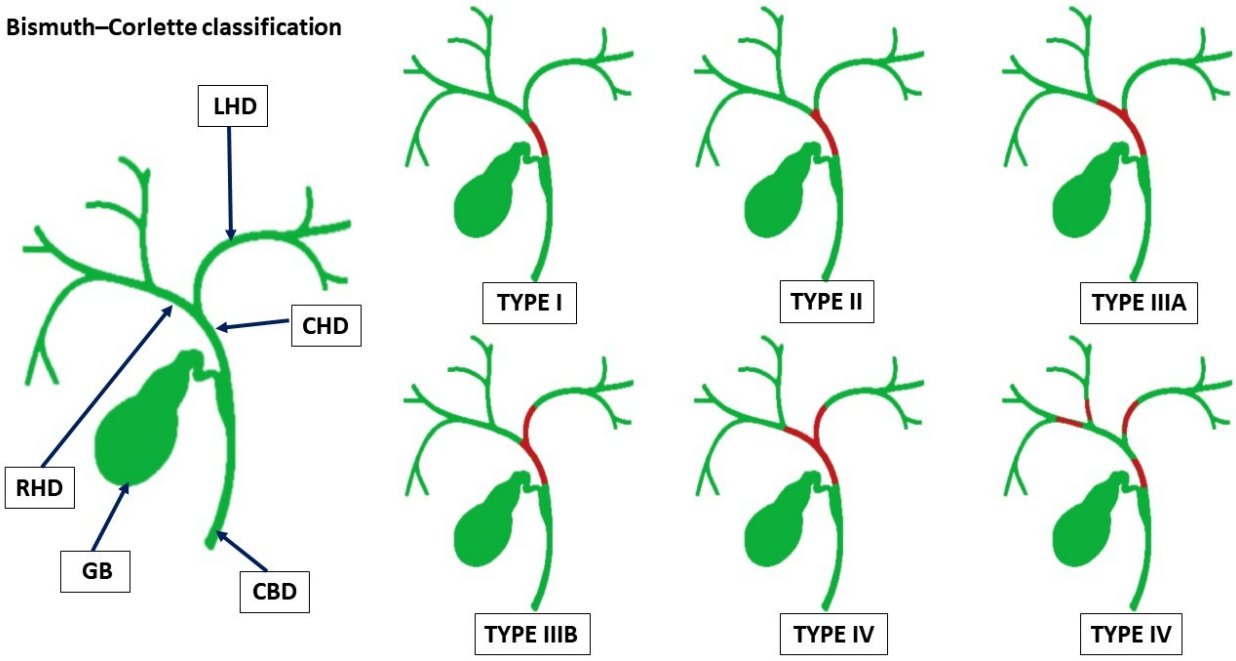

Fig. 1 Bismuth–Corlette Classification.

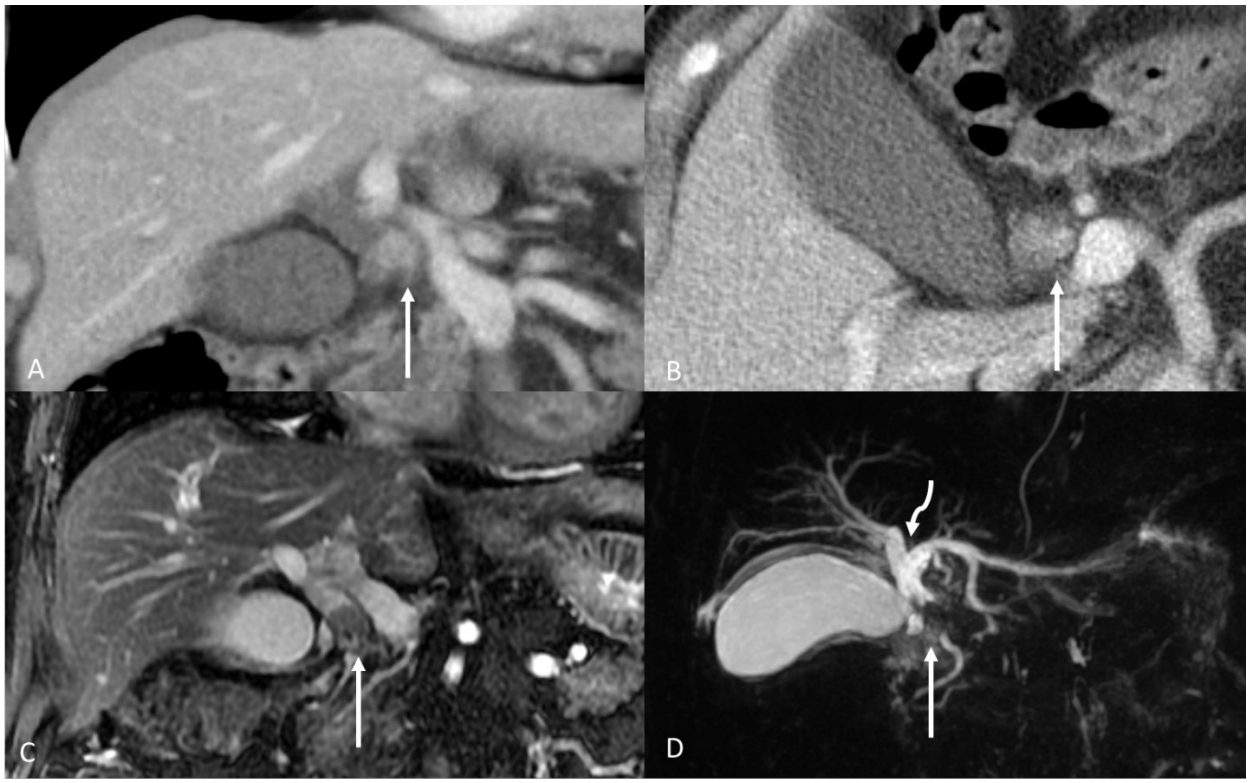

Fig. 2 Coronal (A) and axial (B) contrast-enhanced (CE)CT images of the liver with intravenous contrast show an intraductal soft tissue nodule in the common hepatic duct (arrow) measuring approximately 1.1 cm, not extending to the biliary confluence. The lesion is in close proximity to the main portal vein with no abutment. Coronal T2-weighted image with fat saturation (C) show that the mass demonstrates intermediate signal intensity, while the magnetic resonance cholangiopancreatography sequence shows the mass as a filling defect (arrow) with secondary upstream biliary dilatation (curved arrow). The mass was classified as Bismuth type I.

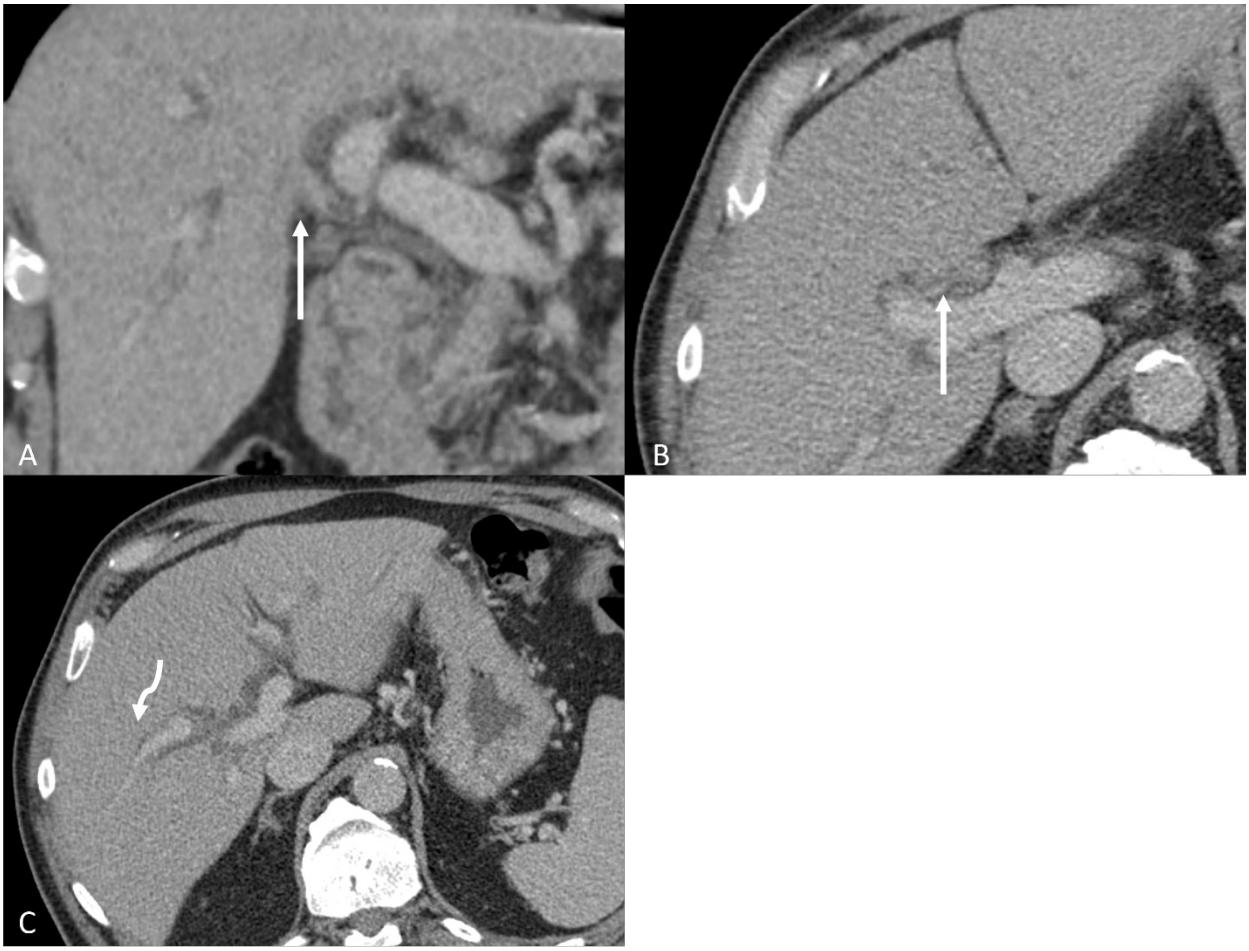

Fig. 3 Coronal (A) and axial (B and C) CT images of the liver with intravenous contrast show a 2.1-cm periductal-infiltrating soft tissue mass at the common hepatic duct and extending to the hilar confluence (arrow) with secondary bilobar biliary dilatation (curved arrows). The mass is in proximity to the right portal vein with no abutment. No hepatic artery involvement is seen. The mass was classified as Bismuth Type II.

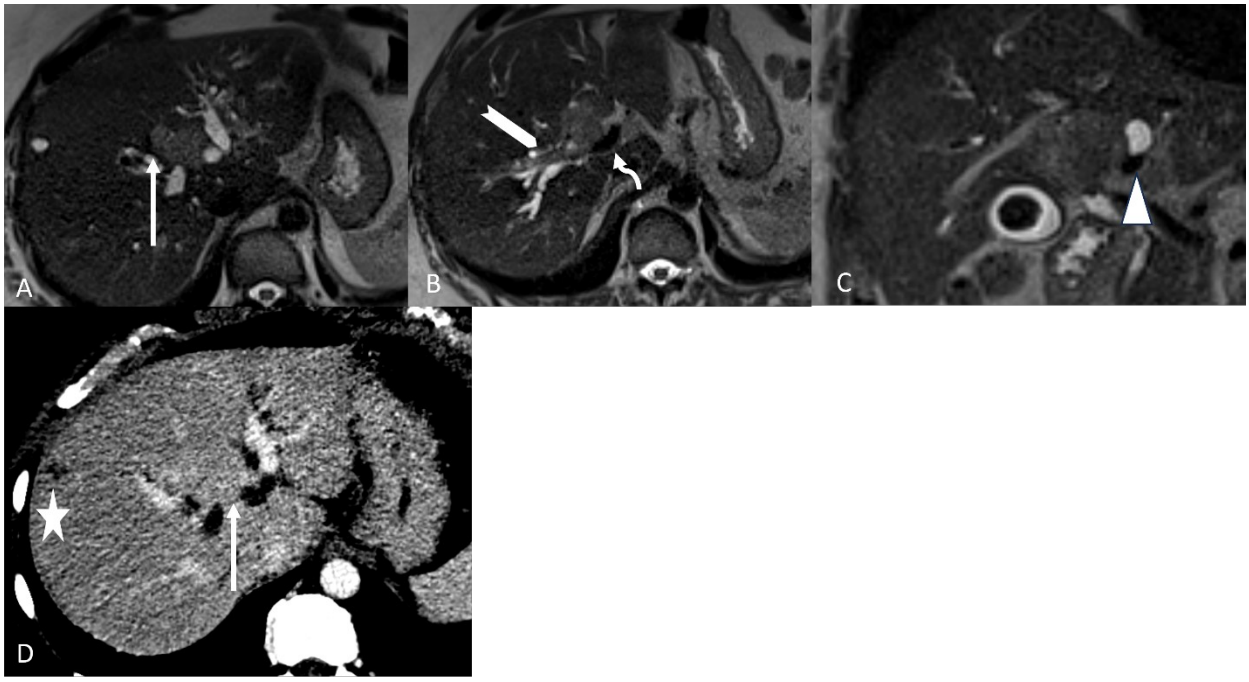

Fig. 4 Axial T2-weighted images of the liver (A and B) show a 2.7-cm mass-forming soft tissue mass of intermediate signal intensity (arrow) at the hepatic hilum and extending to the right secondary duct confluence with secondary bilobar biliary dilatation. The mass is abutting the right hepatic artery (curved arrow) and is invading into the right portal vein (arrowhead). Coronal T2-weighted image (C) shows that the left hepatic artery is not involved (triangle). Axial CT image of the liver with intravenous contrast (D) shows the biliary confluence mass (arrow) with secondary biliary dilatation with a satellite lesion in segment 8 (star). The mass was classified as Bismuth type IIIA.

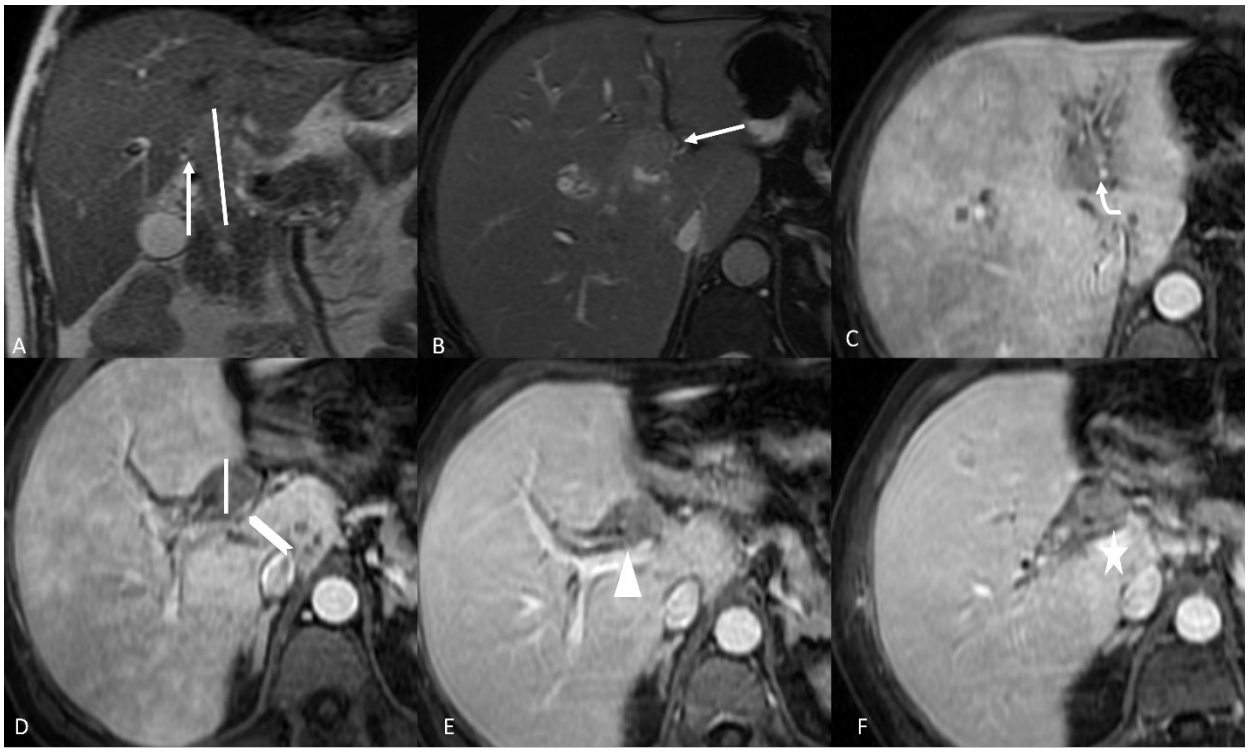

Fig. 5 Coronal (A) and axial (B) T2-weighted images of the liver show a periductal-infiltrating soft tissue mass of intermediate signal intensity, measuring approximately 6.1 cm longitudinally (line in A) and 1.9 cm in radial dimension (line in D), and extending from the common hepatic duct to the biliary bifurcation in addition to the secondary left ductal confluence (arrow). Post-contrast axial T1-weighted image in the arterial phase (C) shows encasement of the left hepatic artery and left portal vein (curved arrow). Post-contrast axial T1-weighted image in arterial phase (D) shows abutment of right hepatic artery (arrowhead). Post-contrast axial T1-weighted images in the venous phase (E and F) show abutment of the right (triangle) and main (star) portal veins. The lesion was classified as Bismuth IIIb.

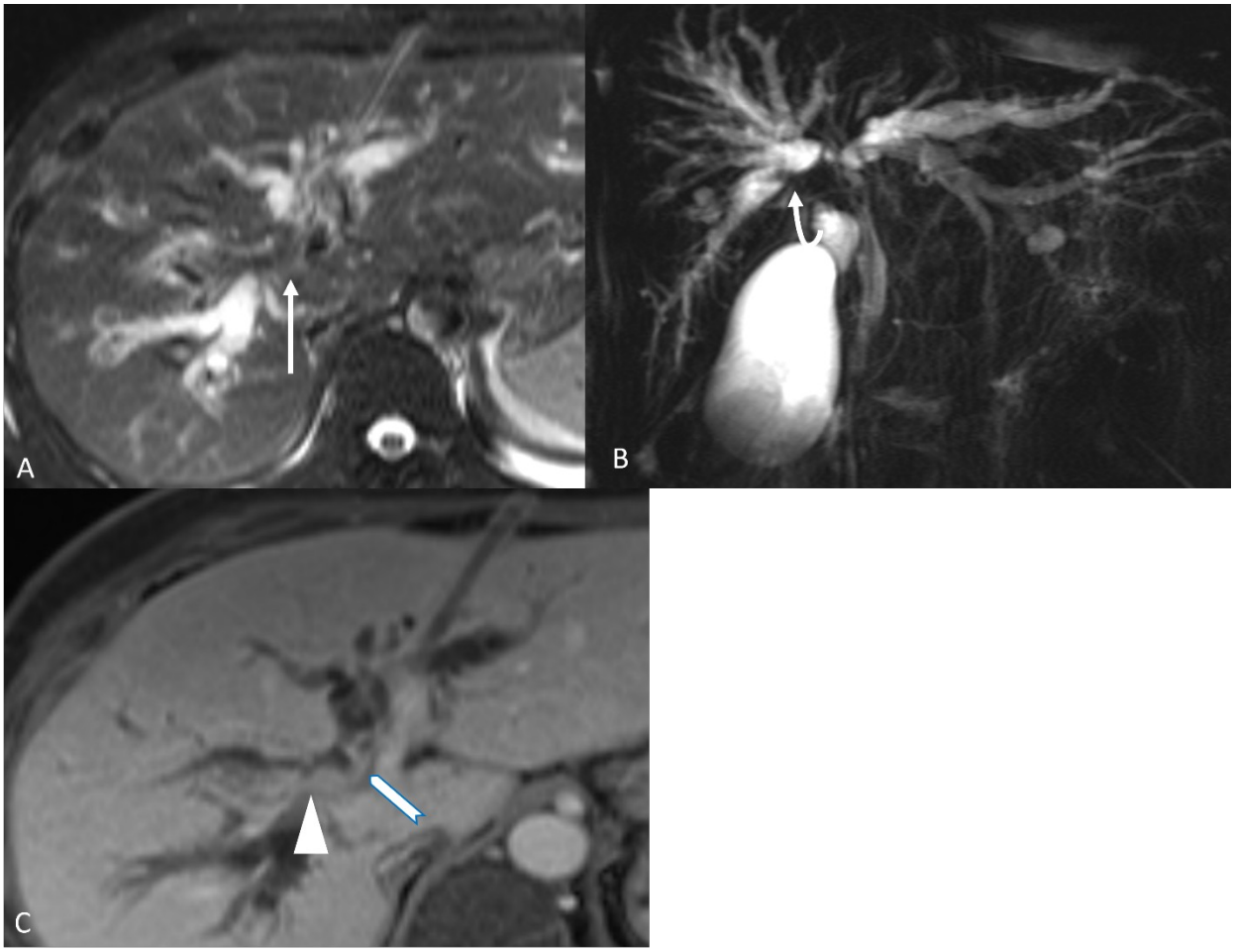

Fig. 6 Axial fat-saturated T2-weighted image (A) of the liver show a mass-forming soft tissue mass of intermediate signal intensity at the hilar bifurcation and extending to the right and left secondary ductal confluence (arrow) with secondary upstream biliary dilatation. The mass is seen as a filling defect (curved arrow) on the magnetic resonance cholangiopancreatography sequence (B). Post-contrast axial T1-weighted image in the venous phase (C) shows enhancement of the mass, abutting the left (arrowhead) and right (triangle) portal veins, the latter appearing mildly narrowed. There was no involvement of the hepatic arteries. This mass was classified as Bismuth type IV.