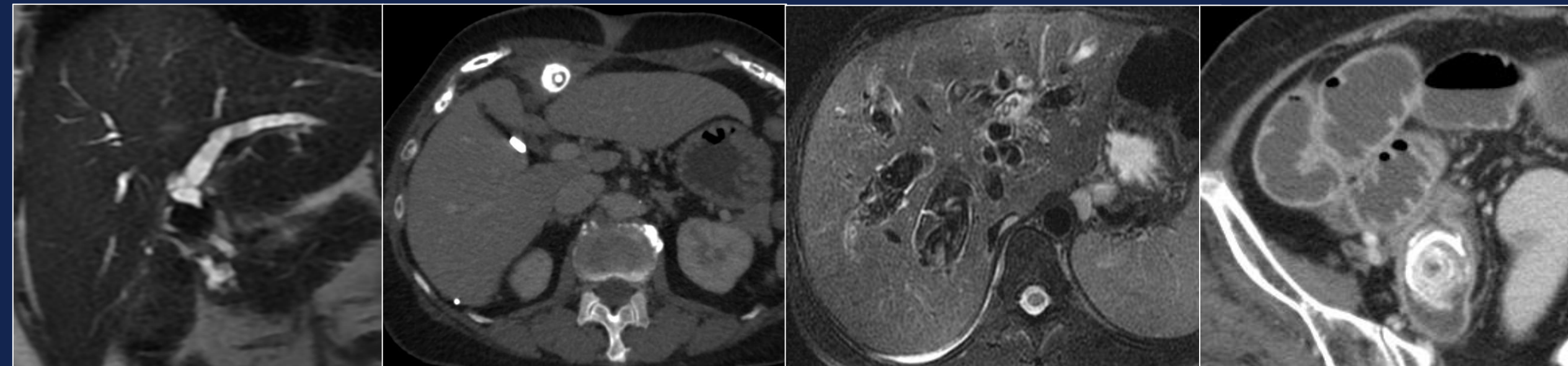


BILIARY STONE DISEASE:

common and unusual presentations that
radiologists should know



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LEARNING OBJECTIVES

- To address the main common and uncommon presentations of gallstone disease, by means of clinical and epidemiological data.
- To describe the main image findings related to pathologies.
- To synthesize the key elements of radiological analysis in the interpretation of common and unusual forms of biliary lithiasis.

BACKGROUND

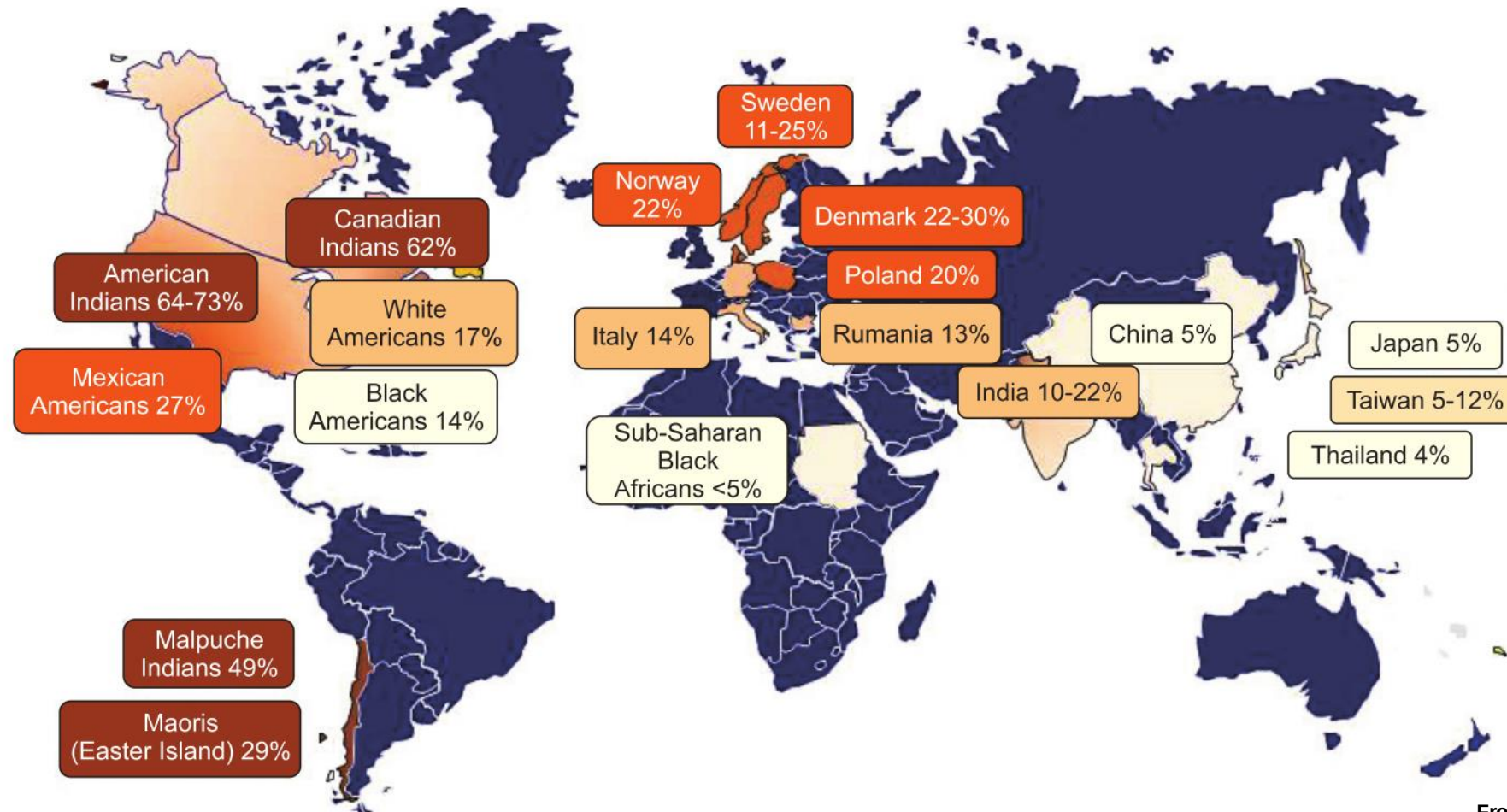
- Gallstones: masses in the gallbladder or biliary tract caused by abnormally high levels of either cholesterol or bilirubin
- Cholesterol gallstones: most common ($> 90\%$)
- Brown and black pigment stones (calcium bilirubin): $< 10\%$
- Higher prevalence:
 - Hispanic populations of Central and South America
 - American hispanics with native american ancestry

BACKGROUND

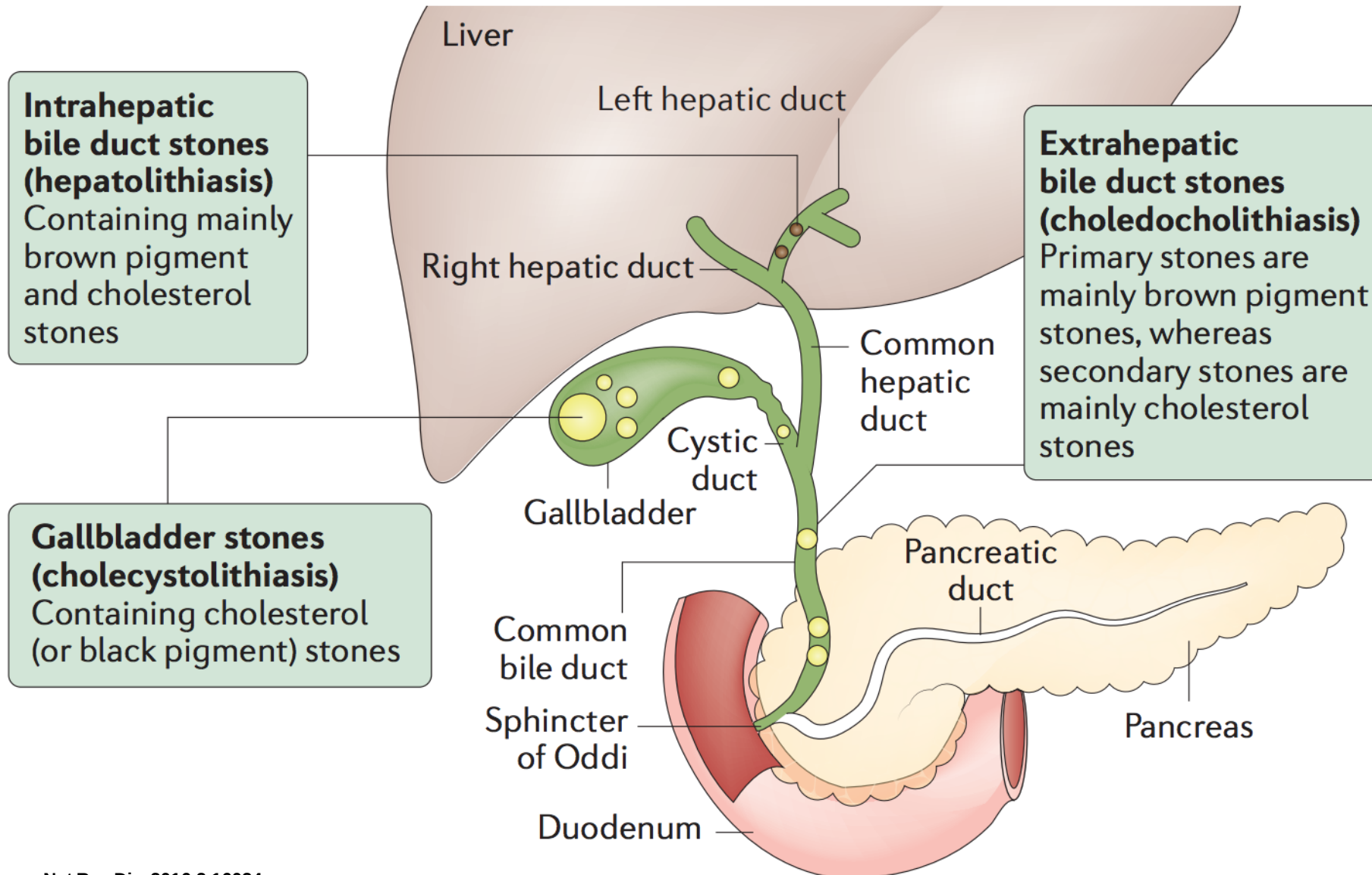
- Stones in the gallbladder (cholecystolithiasis) are the main entity and consist of cholesterol and black pigment gallstones
- Bile duct stones are classified into
 - extrahepatic stones (choledocholithiasis)
 - intrahepatic stones (hepatolithiasis)

WORLDWIDE PREVALENCE OF GALLSTONES

A significant health problem around of the world, affecting 10% to 15% of the adult population



GALLSTONES: SCHEMATIC CLASSIFICATION



IMAGING FINDINGS

ACUTE CHOLECYSTITIS

CHOLEDOCHOLITHIASIS

CHOLEDOCHOLITHIASIS COMPLICATIONS

MIRIZZI SYNDROME

GALLSTONE ILEUS

INTRAHEPATIC LITHIASIS

BILIODIGESTIVE ANASTOMOSIS STENOSIS

DROPPED GALLSTONE

MISCELLANEOUS

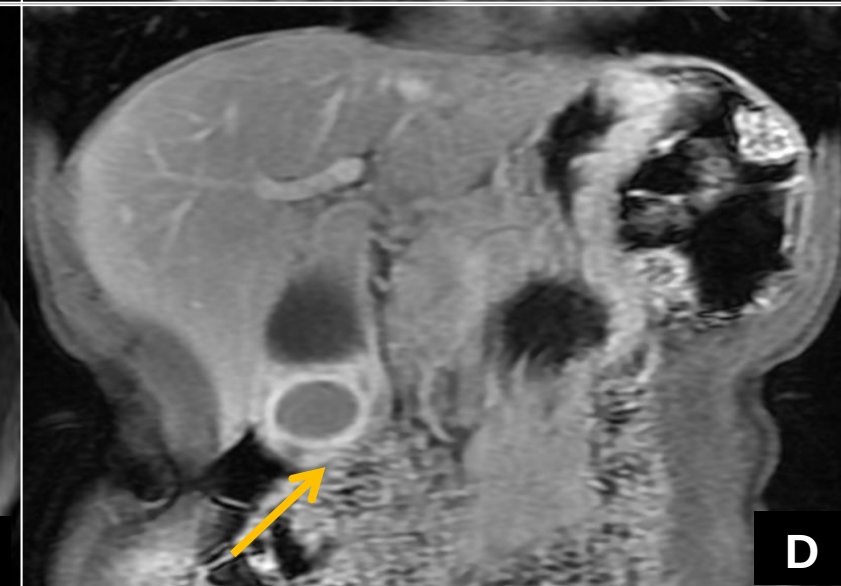
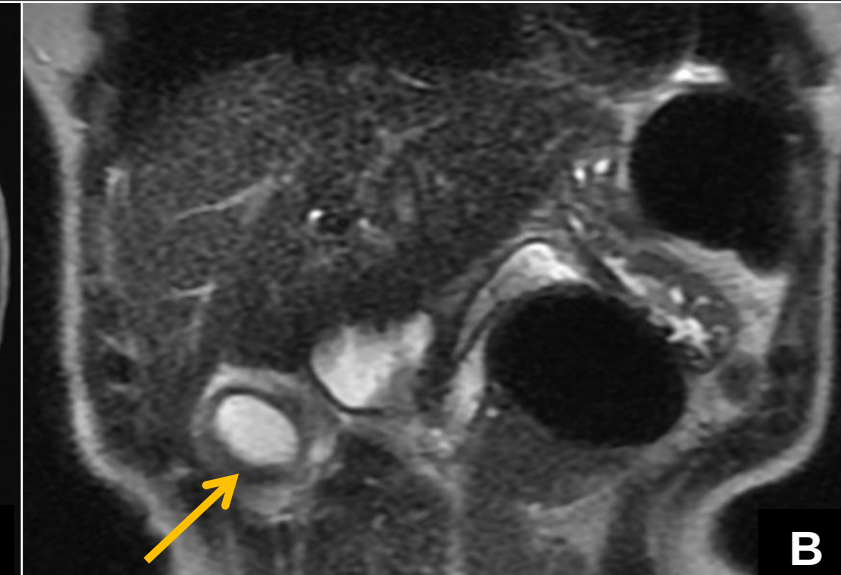
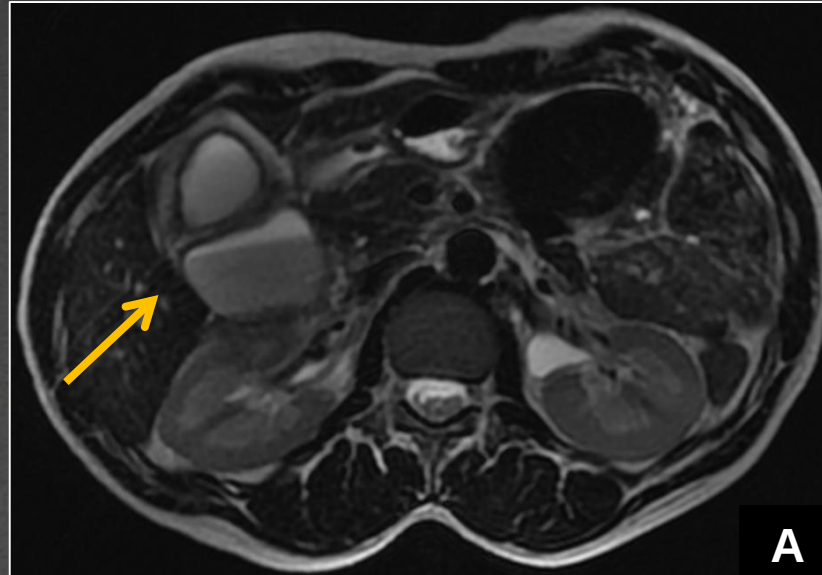
ACUTE CHOLECYSTITIS

- Primary complication of cholecystolithiasis and the most common cause of acute pain in the right upper quadrant
- 90-95% of cases are due to gallstones (acute calculous cholecystitis) with the remainder being acute acalculous cholecystitis
- Complications
 - gangrenous cholecystitis (most common - 20%)
 - gallbladder perforation (~5%)
 - emphysematous cholecystitis
 - pericholecystic abscess
 - cholecystoenteric fistula

ACUTE CHOLECYSTITIS

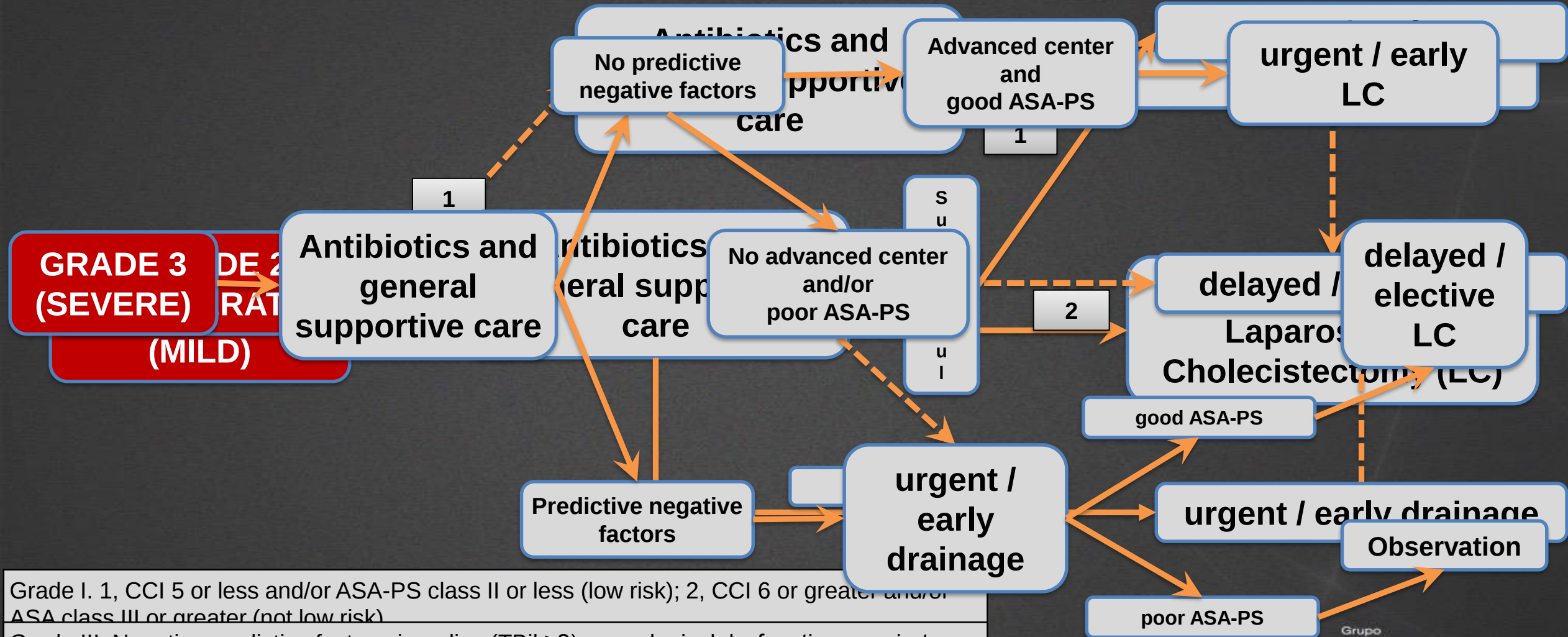
ACUTE CHOLECYSTITIS

Axial (A) and coronal (B) T2-weighted images, axial (C) and coronal (D) contrast-enhanced T1-weighted images demonstrate distended gallbladder with biliary sludge and thickened wall (arrows). Note the appearance of phrygian cap gallbladder that presents the most exuberant inflammatory component.



MANAGEMENT OF ACUTE CHOLECYSTITIS

Tokyo Guidelines 2018



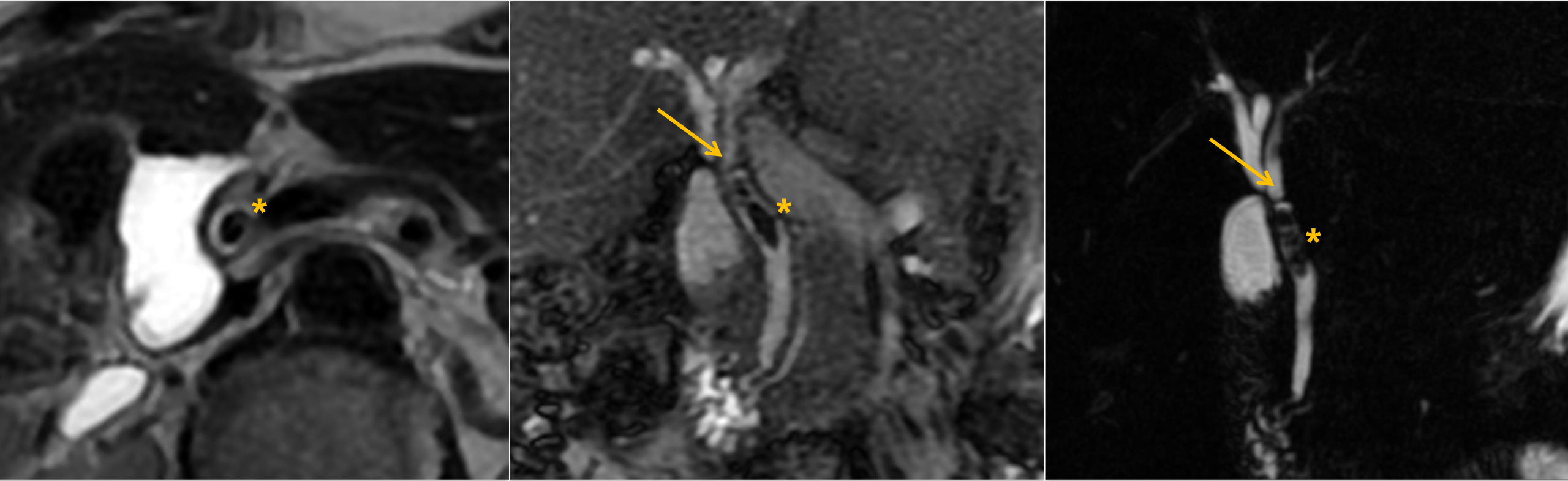
Grade I. 1, CCI 5 or less and/or ASA-PS class II or less (low risk); 2, CCI 6 or greater and/or ASA class III or greater (not low risk)

Grade III. Negative predictive factors: jaundice (TBil ≥ 2), neurological dysfunction, respiratory dysfunction

CHOLEDOCHOLITHIASIS

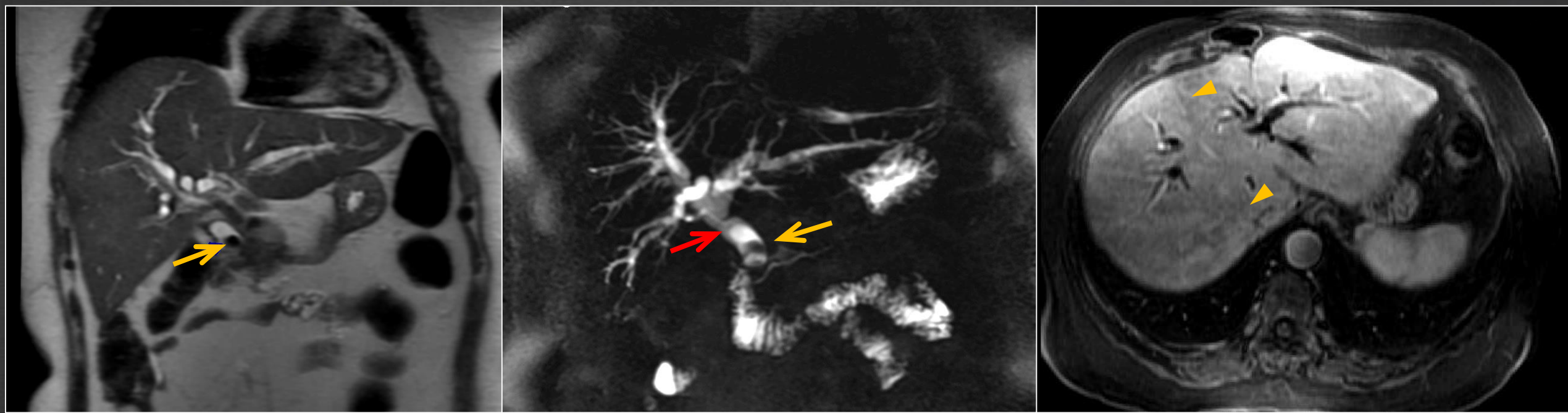
- Presence of gallstones within the bile ducts (common hepatic duct / common bile duct)
- Relatively common
 - Secondary: most common; calculi origins from gallbladder
 - Primary: calculi initiates in common bile duct itself

CHOLEDOCHOLITHIASIS



CHOLEDOCHOLITHIASIS ASSOCIATED WITH BILIARY STENOSIS. Note biliary stenosis (arrows) promoting small dilation of the intrahepatic bile ducts associated with choledocholithiasis.

CHOLEDOCHOLITHIASIS - COMPLICATIONS



CHOLEDOCHOLITHIASIS-RELATED CHOLANGITIS. Note biliary calculus near to duodenal ampulla (yellow arrow) leading to intra and extra-hepatic biliary dilatation (red arrow). Heterogeneous enhancement of the liver parenchyma is also present (yellow arrowhead), which is suggestive of inflammatory hyperemia related to cholangitis,

CHOLEDOCHOLITHIASIS - COMPLICATIONS



SEPTIC THROMBOPHLEBITIS OF THE PORTAL VEIN AS A COMPLICATION OF CHOLANGITIS. Note thrombosis of intrahepatic portal branches (absence of contrast enhancement – yellow arrows) secondary to septic thrombophlebitis and cholangitis related to choledocholithiasis (red arrow)

MIRIZZI SYNDROME

- Gallstone becomes impacted in the neck of the gallbladder or in the cystic duct
- Compression of the common bile duct or common hepatic duct resulting in obstruction with or without jaundice
- May progress into a cholecystocholedochal fistula.
- Reported higher incidence in Latin America



MIRIZZI SYNDROME CLASSIFICATION

Type I: Extrinsic compression in the (common hepatic duct) CHD is caused by stones impacted in the cystic duct or in the infundibulum

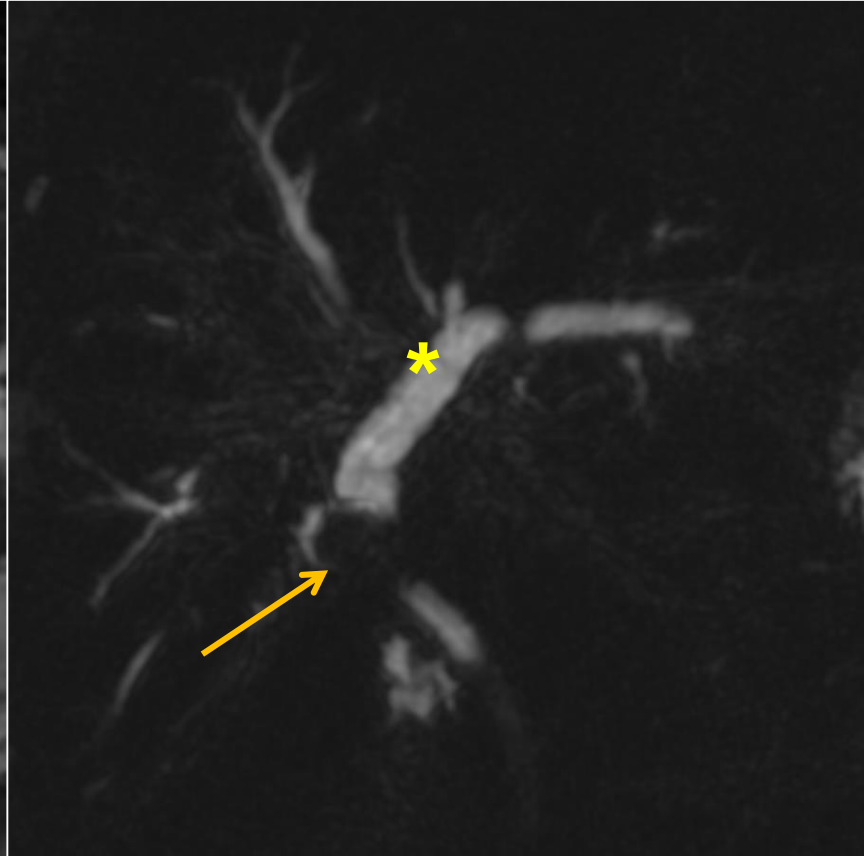
Type II: Presence of cholecystocholedocal biliary fistula (CCBF) involving one third of the circumference of the CHD wall

Type III: Presence of cholecystocholedocal biliary fistula (CCBF) with a diameter over two thirds of the circumference of the CHD wall

Type IV: Presence of cholecystocholedocal biliary fistula (CCBF) which involves the entire circumference of the CHD wall

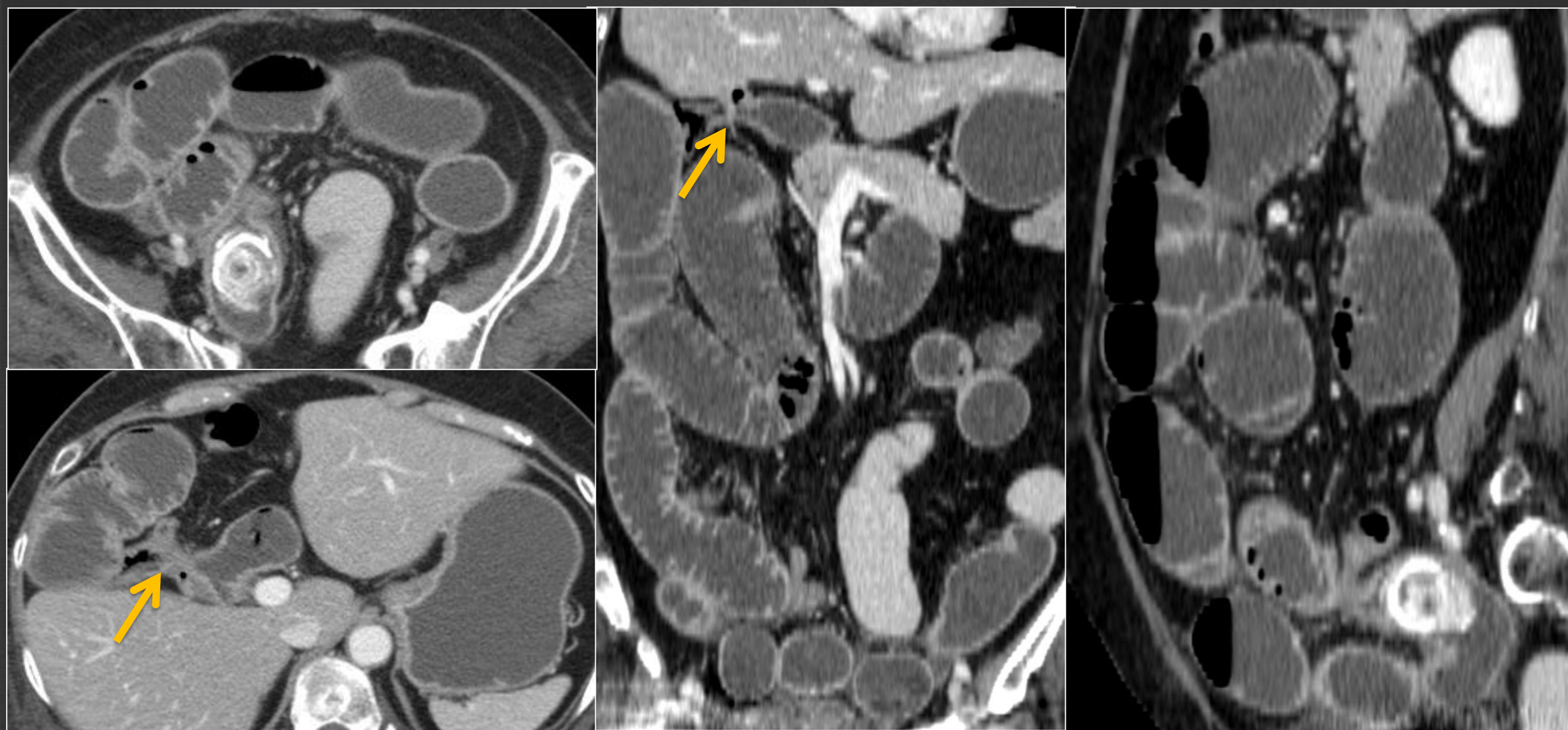
MIRIZZI SYNDROME

MIRIZZI SYNDROME. Gallstone impacted in the infundibulum of the gallbladder (arrows) leading to extrinsic compression of the choledochal duct and dilation of the intrahepatic bile ducts (*).



GALLSTONE ILEUS

- Gallstone ileus is a mechanical intestinal obstruction due to gallstone impaction within the gastrointestinal tract
- Less than 1% of cases of intestinal obstruction are derived from this etiology
- It is a rare complication of chronic cholecystitis
- Fistula between the gallbladder and the adjacent and adhered portion of the gastrointestinal tract, with further gallstone passage
- Less common locations include the stomach and the duodenum (Bouveret's syndrome), and the colon



GALLSTONE ILEUS. Patient with bowel obstruction, presenting cholecystoduodenal fistula (red arrow) and calculus at distal ileus, promoting dilatation of intestinal loops.

INTRAHEPATIC LITHIASIS

- Calculus located proximal to the confluence of the left and/or right hepatic ducts
- Include brown pigment stones (calcium bilirubin stones), cholesterol stones and their mixture
- Usually accompanied with extrahepatic stones and have properties of multiple complications, high postoperative recurrence rates and serious systemic damage

INTRAHEPATIC LITHIASIS

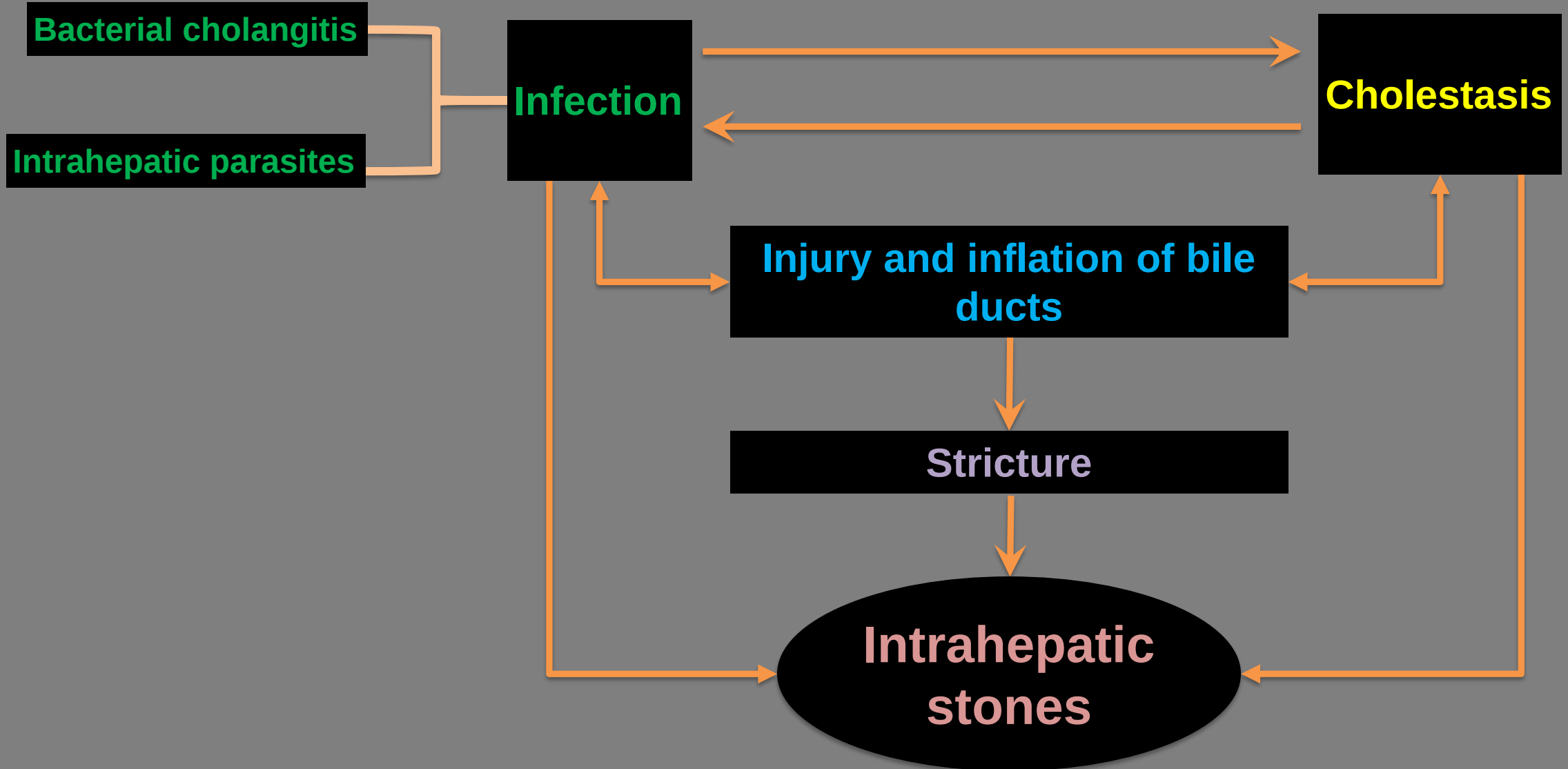
- Association between liver fluke infection and intrahepatic stone
- Common in East Asia, including China, Japan, and South Korea
- *Clonorchis sinensis*
- *Opisthorchis viverrini*
- *Ascaris lumbricoidis*
- *Schistosoma mansoni*



INTRAHEPATIC GALLSTONE FORMATION

- Bile acid is accumulated in liver and blood and may bring injury
- The mechanical obstruction in the distal common bile duct is a importante factor
- Sometimes, there is a functional obstruction which is formed by distal common bile duct edema and spasm of Oddi`s sphinter caused by cholangitis
- Low-protein diets may reduce the level of β -glucuronidase inhibitor in bile contributing to the formation of pigment stones

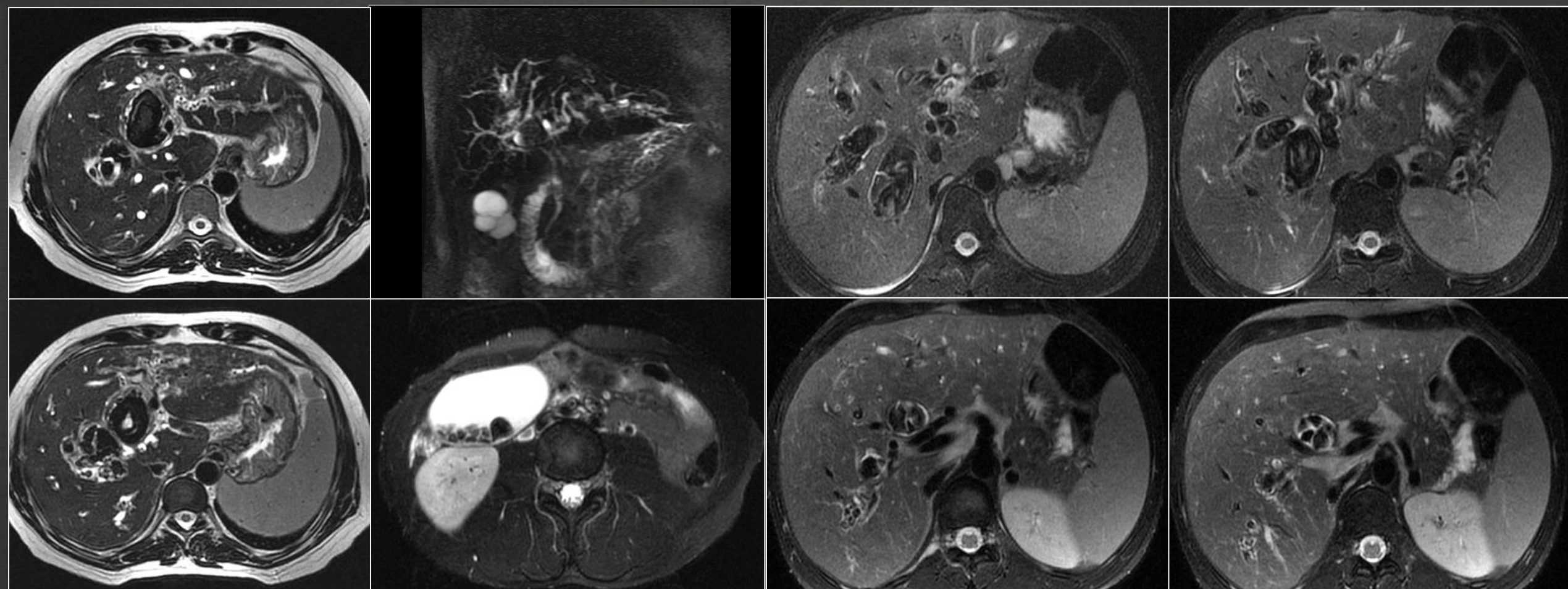
INTRAHEPATIC LITHIASIS



INTRAHEPATIC LITHIASIS

LOW PHOSPHOLIPID-ASSOCIATED CHOLELITHIASIS (LPAC) SYNDROME

Intrahepatic lithiasis related to ABCB4/MDR3 gene variants, mostly associated with a peculiar form of cholelithiasis.

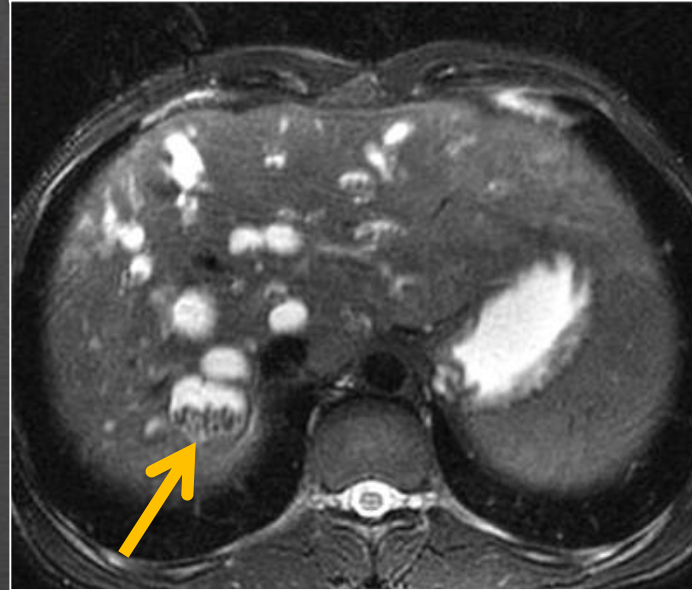
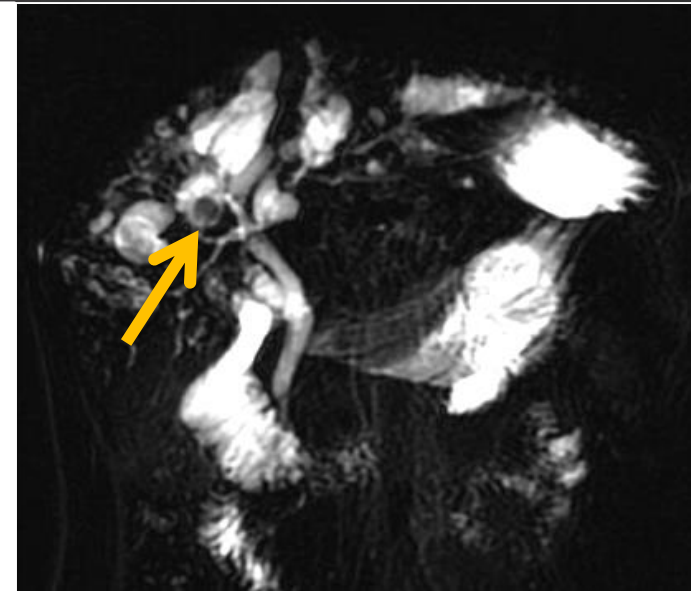
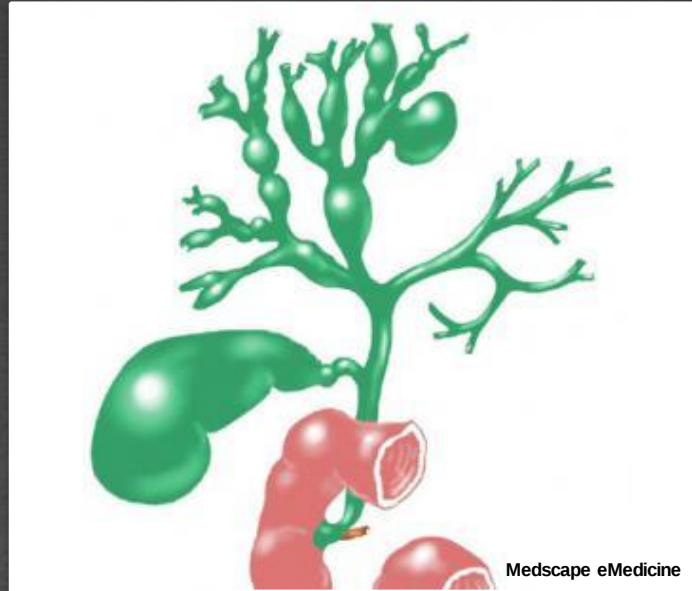


INTRAHEPATIC LITHIASIS

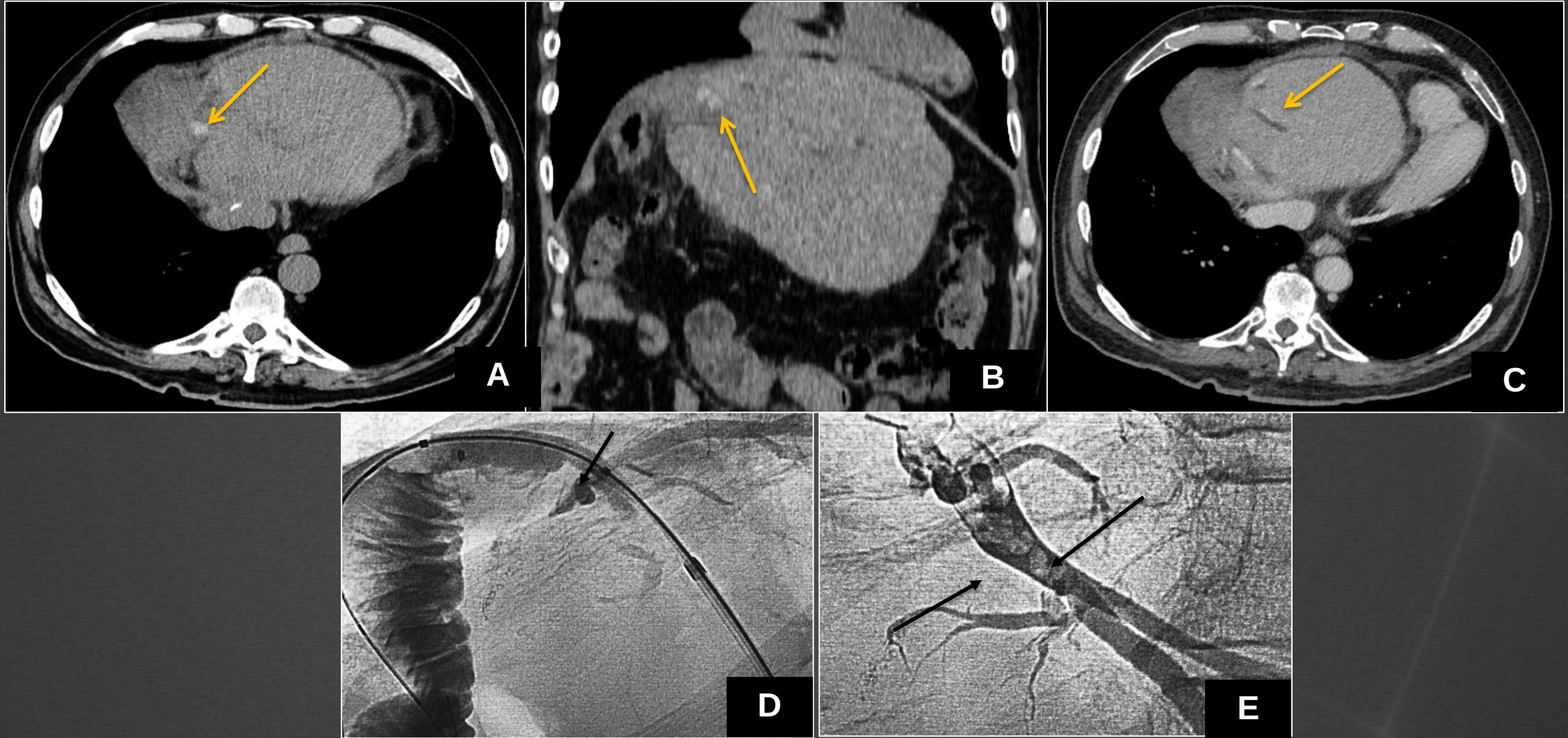
INTRAHEPATIC LITHIASIS AND CAROLI DISEASE

Note segmental cystic dilatation of the intrahepatic ducts (Caroli Disease) associated with intrahepatic lithiasis (yellow arrows).

Caroli disease presents increased incidence of biliary lithiasis, cholangitis and liver abscesses; absence of cirrhosis and portal hypertension; and association of renal tubular ectasia or similar renal cystic disease



BILIODIGESTIVE ANASTOMOSIS STENOSIS



CHOLEDOCHOLITHIASIS AFTER SURGICAL COMPLICATION. (A) Axial and (B) coronal non-enhanced CT images showing small hyperattenuating foci at the level of the hepaticojejunostomy, compatible with biliary stones. (C) Axial portal venous phase CT image demonstrates associated upstream biliary ectasia. Cholangiography images (D and E) confirms the presence of **hepaticojejunostomy stricture**

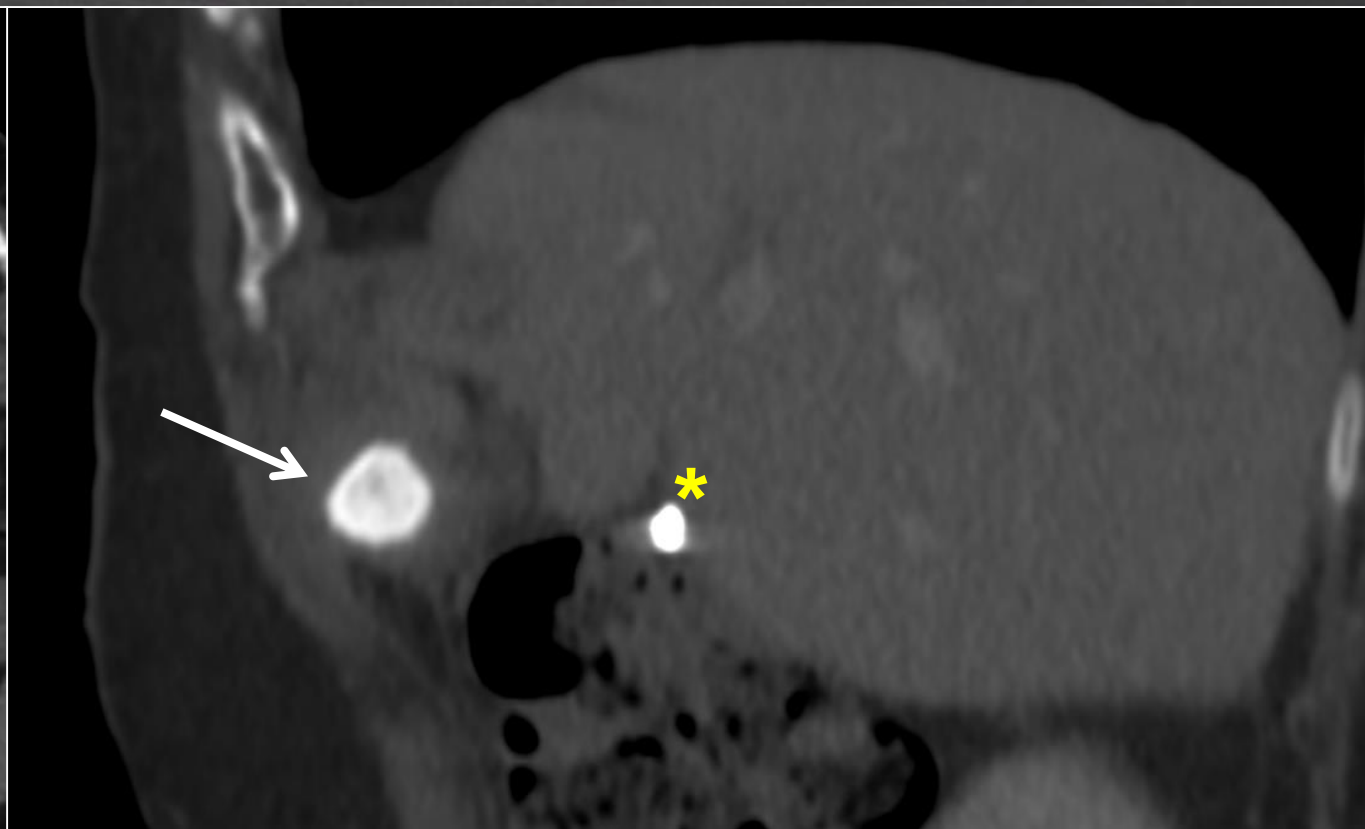
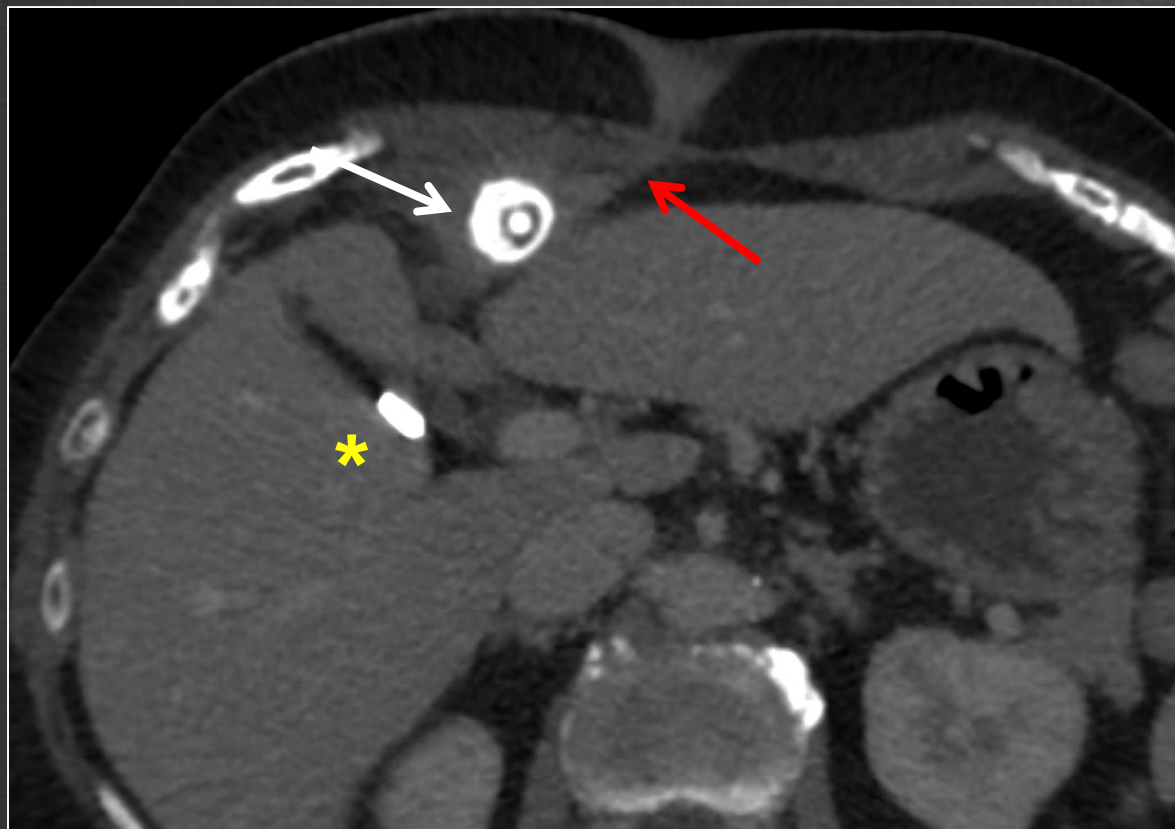
DROPPED GALLSTONE

- Spillaged of stones into the intraperitoneal space owing to perforation of the gallbladder during cholecystectomy
- Around 30% of cholecystectomy
- DGs is the formation of an abscess around the DG, which is presumably the source of infection
 - most frequently located near the liver
 - fistula formation is possible, but less frequent

DROPPED GALLSTONE

DROPPED GALLSTONE AFTER CHOLECYSTECTOMY

72 years-old female patient previously submitted to laparoscopic cholecystectomy (*) presents a dropped gallstone (white arrow) complicating with a fistulous pathway to the abdominal wall (red arrow)

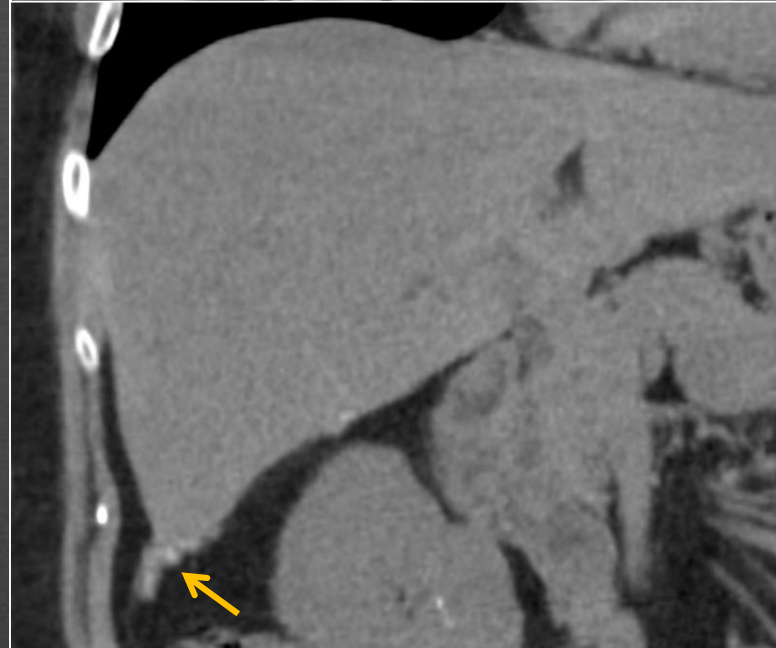
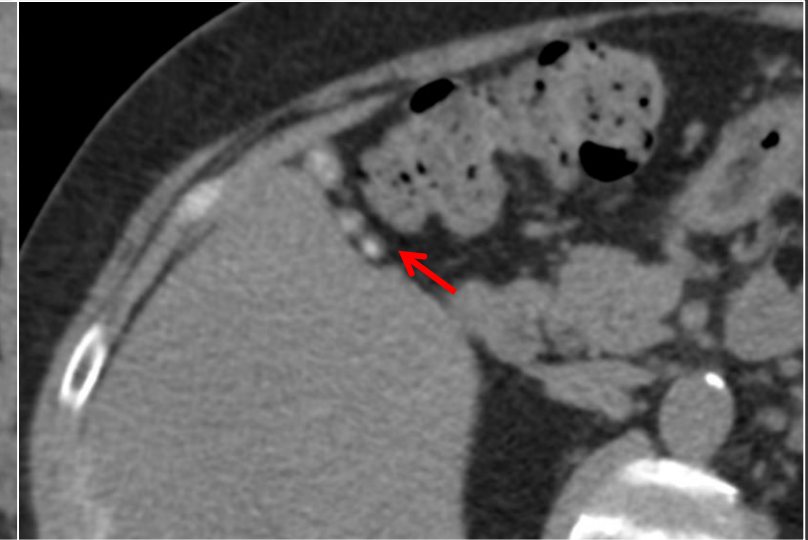
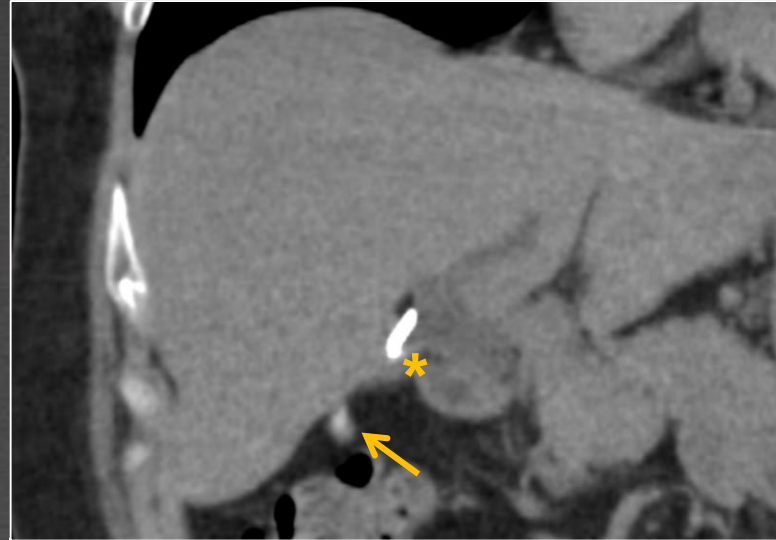


DROPPED GALLSTONE

DROPPED GALLSTONE AFTER CHOLECYSTECTOMY

Patient with history of cholecystectomy (*) submitted to CT for kidney stones evaluation.

CT images show multiple dropped gallstones adjacent to gallbladder bed (red arrow) and liver capsule (yellow arrow) incidentally characterized.

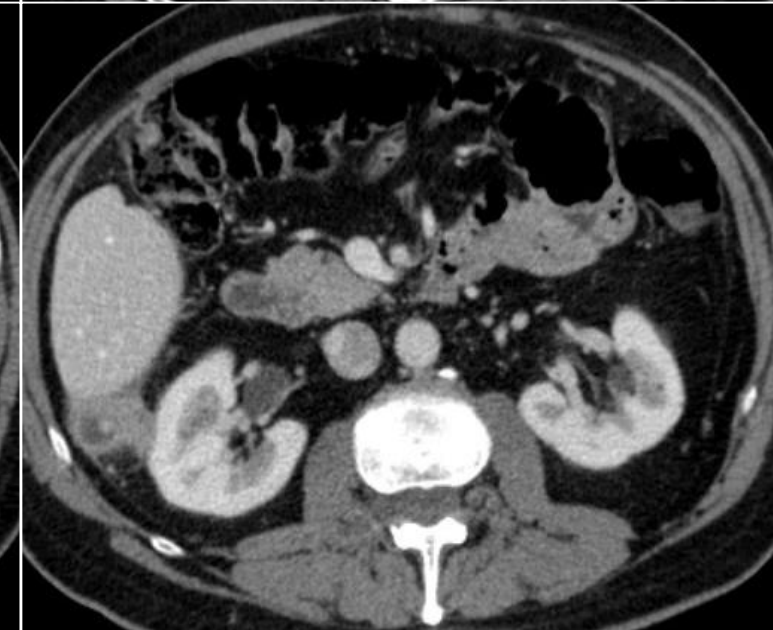
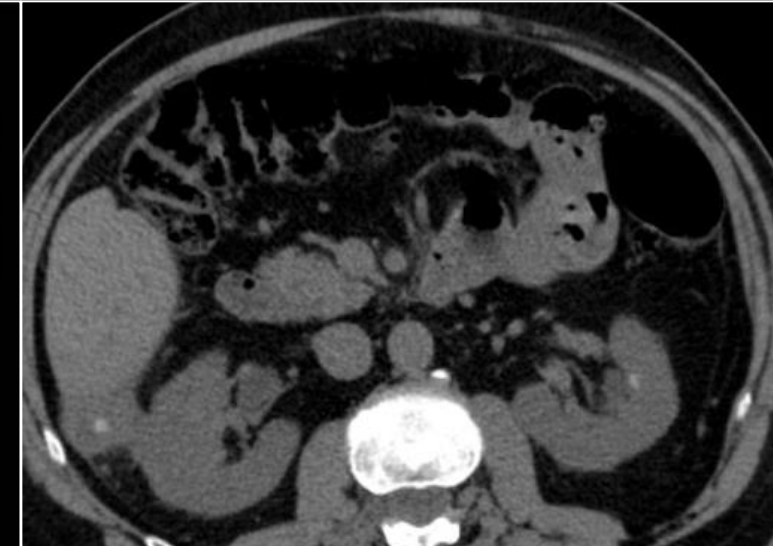


DROPPED GALLSTONE

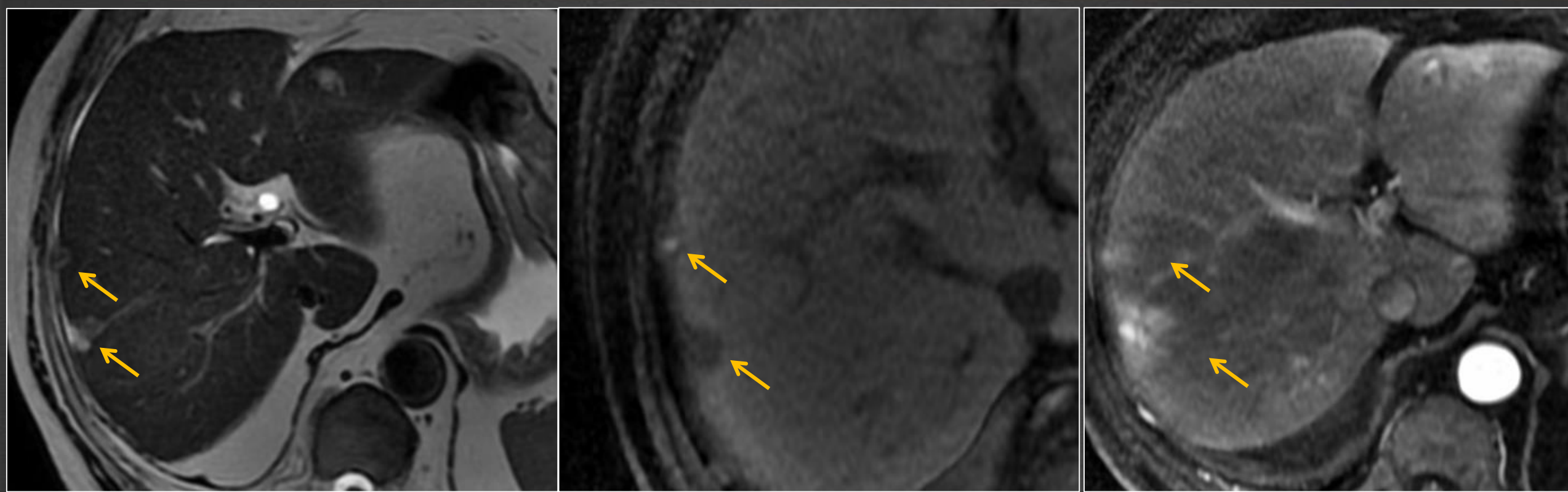
DROPPED GALLSTONE AFTER CHOLECYSTECTOMY

Patient with abdominal pain and history of cholecystectomy. US image presents a collection near to hepatic segment VI with a calcification inside.

Later CT reveals dropped gallstone complicated with abscess.



DROPPED GALLSTONE

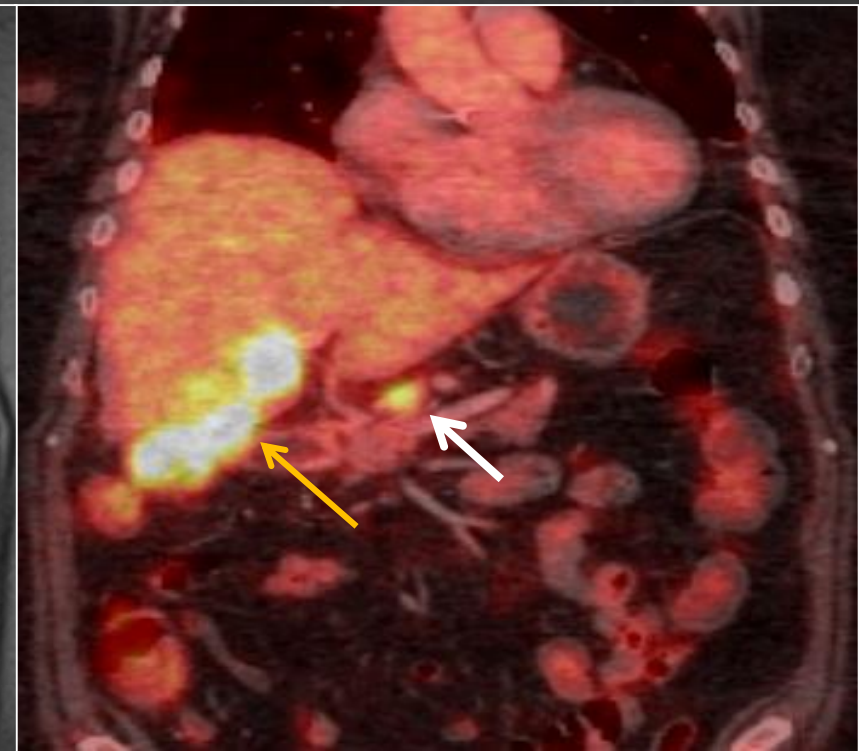
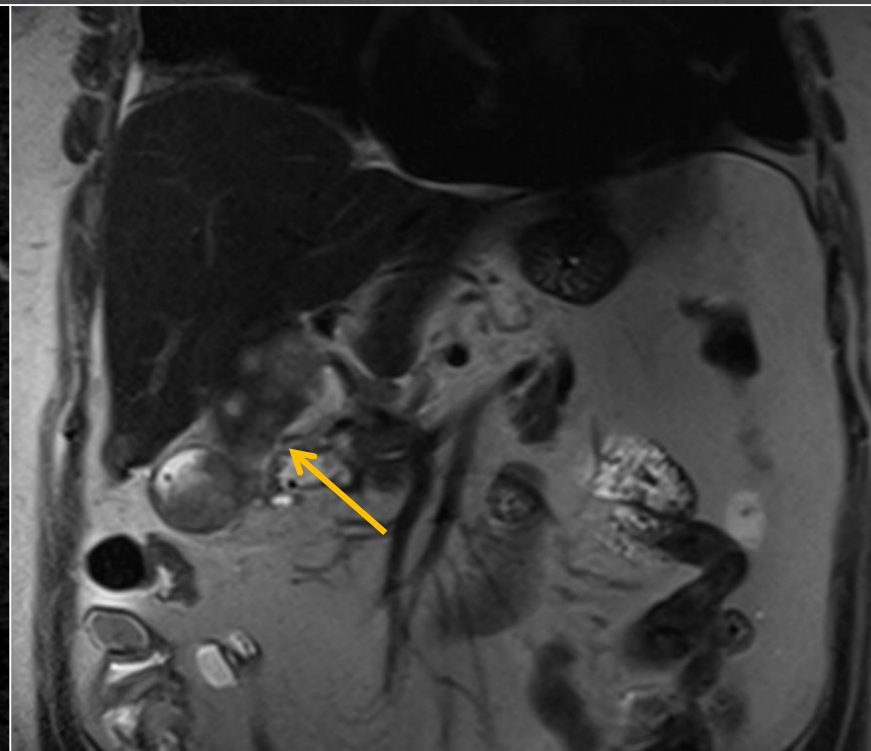


DROPPED GALLSTONES. 79-year-old man, abdominal pain following laparoscopic cholecystectomy. MRI images show subcapsular small tiny gallstones with associated enhancement of the adjacent liver parenchyma due to reactive hyperaemia.

MISCELLANEOUS

GALLBLADDER TUMOR AND CHOLECYSTOLITHIASIS

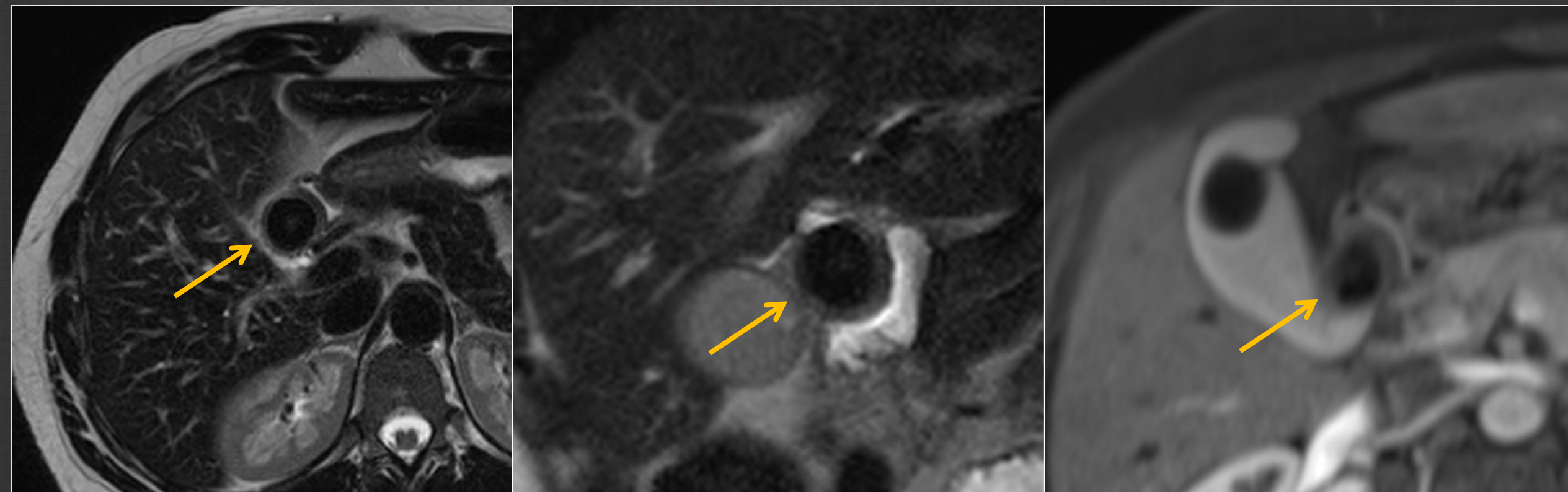
CT and MRI images showing an ill defined mass involving the gallbladder (yellow arrows) which contains small dense stones on the fundus portion (red arrow). PET-CT image shows high FDG uptake in the gallbladder mass and hilar lymph node (white arrow). Laparoscopic biopsy confirmed the diagnosis of gallbladder carcinoma.



MISCELLANEOUS

EXTRINSIC DUODENAL COMPRESSION BY INFUNDIBULAR CALCULUS

Patient with a history of duodenal extrinsic compression characterized in a previous endoscopic study. In the subsequent MR evaluation it is noted that duodenal compression is determined by gallstone impacted in the gallbladder infundibulum (arrows).



CONCLUSION

Gallstones represent a broad spectrum of clinical-radiological presentation. Since they are a frequent health problem, it is necessary for the radiologist to know the common and unusual presentations of this disease.

Grupo



DASA