

The background is a dark blue gradient with a subtle pattern of concentric circles and a degree scale. The scale is a large arc on the left side, with markings from 40 to 260 in increments of 10. There are also smaller concentric circles and dashed lines scattered across the background.

THE GALLBLADDER **EVALUATION AND** **TREATMENT**

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GENERAL SURGEON

LICKING MEMORIAL HOSPITAL

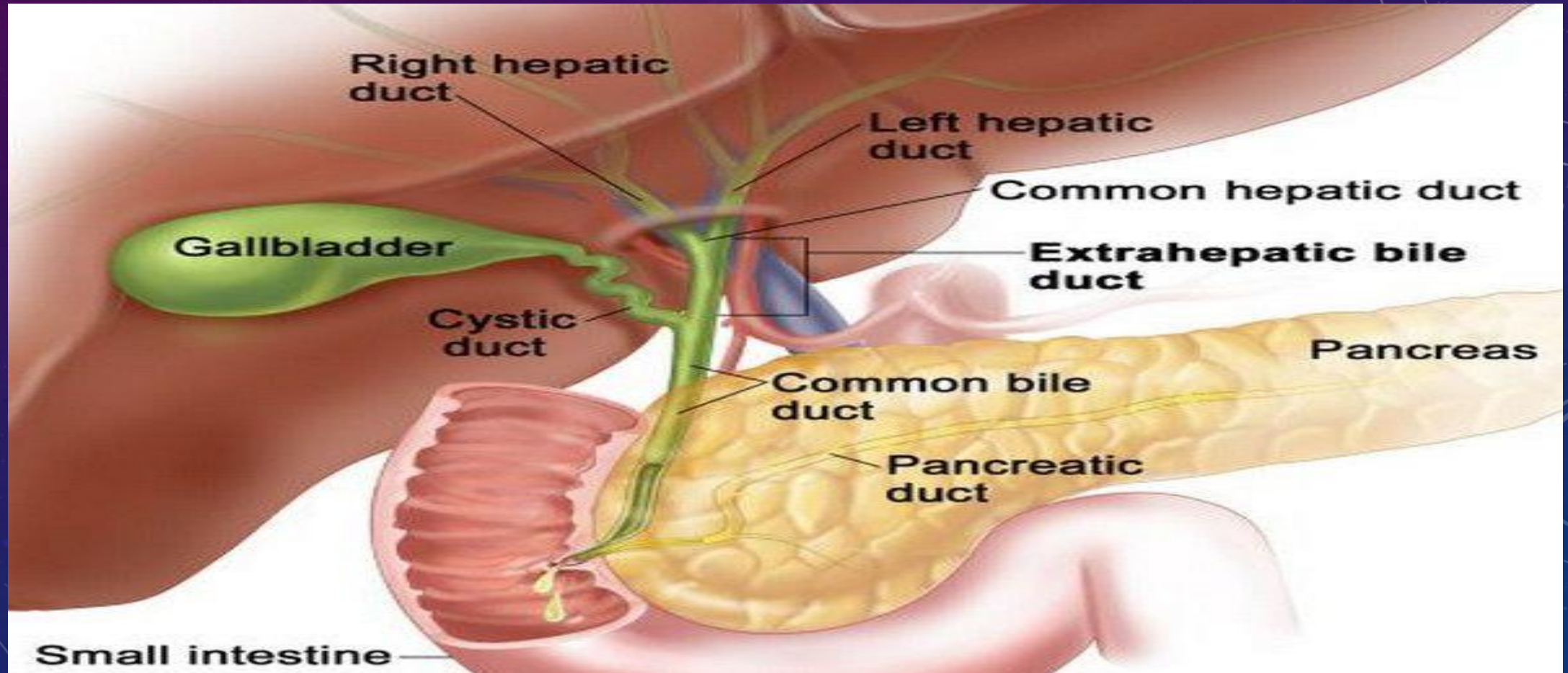
DISCLOSURE STATEMENT

- I have no relevant disclosures to report

OUTLINE

- Anatomy
- Function
- Disease states
- Treatment
- Discussion

GALLBLADDER BASICS

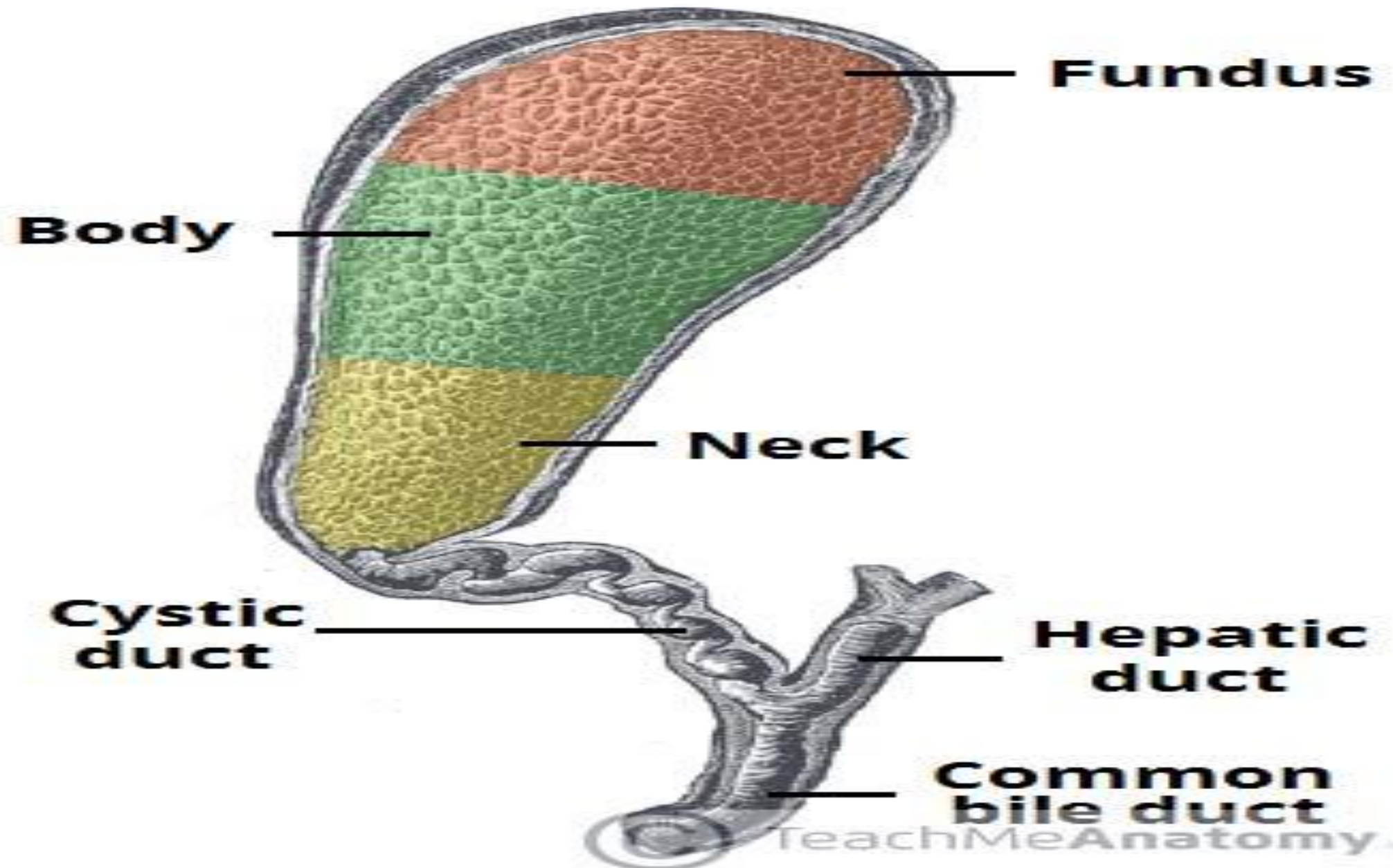


GALLBLADDER BASICS

- The **gallbladder** is a gastrointestinal organ located within the right hypochondrial region of the abdomen. This intraperitoneal, pear-shaped sac lies within a fossa formed between the inferior aspects of the right and quadrate lobes of the liver.
- The primary function of the gallbladder is to concentrate and store **bile** which is produced by the liver. As part of the gustatory response, the stored bile is then released from the gallbladder in response to cholecystokinin.

GALLBLADDER BASICS

- The gallbladder has a storage capacity of 30-50ml and, in life, lies anterior to the first part of the duodenum. It is typically divided into three parts:
- **Fundus** – the rounded, distal portion of the gallbladder. It projects into the inferior surface of the liver in the mid-clavicular line.
- **Body** – the largest part of the gallbladder. It lies adjacent to the posteroinferior aspect of the liver, transverse colon and superior part of the duodenum.
- **Neck** – the gallbladder tapers to become continuous with the cystic duct, leading into the biliary tree.
 - The neck contains a mucosal fold, known as Hartmann's Pouch. This is a common location for gallstones to become lodged, causing cholestasis.



GALLBLADDER DISEASE

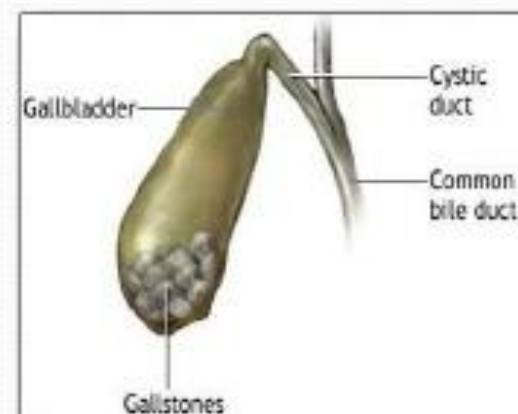
- Cholecystitis:
 - Calculous
 - Acalculous
- Biliary Dyskinesia
- Gallstone Pancreatitis

CHOLELITHIASIS

- In developed countries, about 10% of adults and 20% of people > 65 yr have gallstones, but 80% are asymptomatic.
- Patients with asymptomatic gallstones become symptomatic at a rate of about 2%/yr. The symptom that develops most commonly is biliary colic rather than a major biliary complication. Once biliary symptoms begin, they are likely to recur; pain returns in 20 to 40% of patients/yr, and about 1 to 2% of patients/yr develop complications such as cholecystitis, choledocholithiasis, cholangitis, and gallstone pancreatitis.

Cholelithiasis

- Chole= gallbladder
- Lithiasis= stone
- Pathophysiology of gallstone formation
 - Form secondary to abnormal bile constituents
 - Mechanisms of gallstone formation
 - Increased biliary secretion of cholesterol
 - Cholesterol crystals precipitate and form a “stone”
 - Gallbladder hypomotility
 - Types of Gallstones
 - Cholesterol 80% of stones
 - Calcium bilirubinate (pigment) <20% of stones
 - Biliary sludge
 - Mucus like (supersaturation of bile with either cholesterol or calcium bilirubinate)
 - Likely a precursor to stones





RISK FACTORS FOR GALLSTONES

Women>Men

Increases with age, especially after the age of 40 years.

Pregnancy

Use of medicines that contain estrogen

Obesity

Frequent fasting

Rapid weight loss (including patients who have surgical weight loss treatments)

Diabetes mellitus, Sickle cell disease, Cirrhosis

ACUTE CHOLECYSTITIS

- CALCULOUS
- ACALCULOUS

ACUTE CALCULOUS

- Acute cholecystitis is the most common complication of cholelithiasis. Conversely, $\geq 95\%$ of patients with acute cholecystitis have cholelithiasis. When a stone becomes impacted in the cystic duct and persistently obstructs it, acute inflammation results. Bile stasis triggers release of inflammatory enzymes (eg, phospholipase A, which converts lecithin to lysolecithin, which then may mediate inflammation).

ACUTE CALCULOUS

- The damaged mucosa secretes more fluid into the gallbladder lumen than it absorbs. The resulting distention further releases inflammatory mediators (eg, prostaglandins), worsening mucosal damage and causing ischemia, all of which perpetuate inflammation. Bacterial infection can supervene. The vicious circle of fluid secretion and inflammation, when unchecked, leads to necrosis and perforation.

ACUTE CALCULOUS

- If acute inflammation resolves then continues to recur, the gallbladder becomes fibrotic and contracted and does not concentrate bile or empty normally—features of chronic cholecystitis.

ACUTE ACALCULOUS

- Acalculous cholecystitis is cholecystitis without stones. It accounts for 5 to 10% of cholecystectomies done for acute cholecystitis

ACUTE CHOLECYSTITIS

- Severe pain in your upper right or center abdomen
- Pain that spreads to your right shoulder or back
- Tenderness over your abdomen with palpation
- Nausea
- Vomiting
- Fever

ACUTE ACALCULOUS

- Risk factors include the following:
 - Critical illness (eg, major surgery, burns, sepsis, or trauma)
 - Prolonged fasting or TPN (both predispose to bile stasis)
 - Shock
 - Immune deficiency
 - Vasculitis (eg, SLE, polyarteritis nodosa)

ACUTE ACALCULOUS

- The mechanism probably involves inflammatory mediators released because of ischemia, infection, or bile stasis. Sometimes an infecting organism can be identified (eg, *Salmonella* sp or cytomegalovirus in immunodeficient patients). In young children, acute acalculous cholecystitis tends to follow a febrile illness without an identifiable infecting organism.

ACUTE ACALCULOUS

- Acute acalculous cholecystitis is suggested if a patient has no gallstones but has ultrasonographic Murphy sign or a thickened gallbladder wall and pericholecystic fluid. A distended gallbladder, biliary sludge, and a thickened gallbladder wall without pericholecystic fluid (due to low albumin or ascites) may result simply from a critical illness.

BILIARY DYSKINESIA

- Biliary dyskinesia is a state which affects the motility of the sphincter of Oddi, gallbladder, and biliary ducts, reducing the speed of bile excretion. Patients with this disorder experience biliary-type pain, even though diagnostic tools show that there is no evidence of gallstones or cholecystitis.

BILIARY DYSKINESIA

- The true incidence of acalculous cholecystopathy in the United States is unknown, although the condition occurs more frequently in females than males and in individuals aged 40-60 years. However, with the advent of laparoscopic cholecystectomy, data exist that suggest an increased rate of cholecystectomy. In general, 10-15% of patients undergoing laparoscopic cholecystectomy have biliary dyskinesia.

BILIARY DYSKINESIA

Increased risk for biliary dyskinesia

- Inflammation of the muscles that control bile flow from the gallbladder
- Problems with the way the muscles work together
- A chronic disease such as diabetes or celiac disease
- Obesity
- Hormone imbalance

BILIARY DYSKINESIA

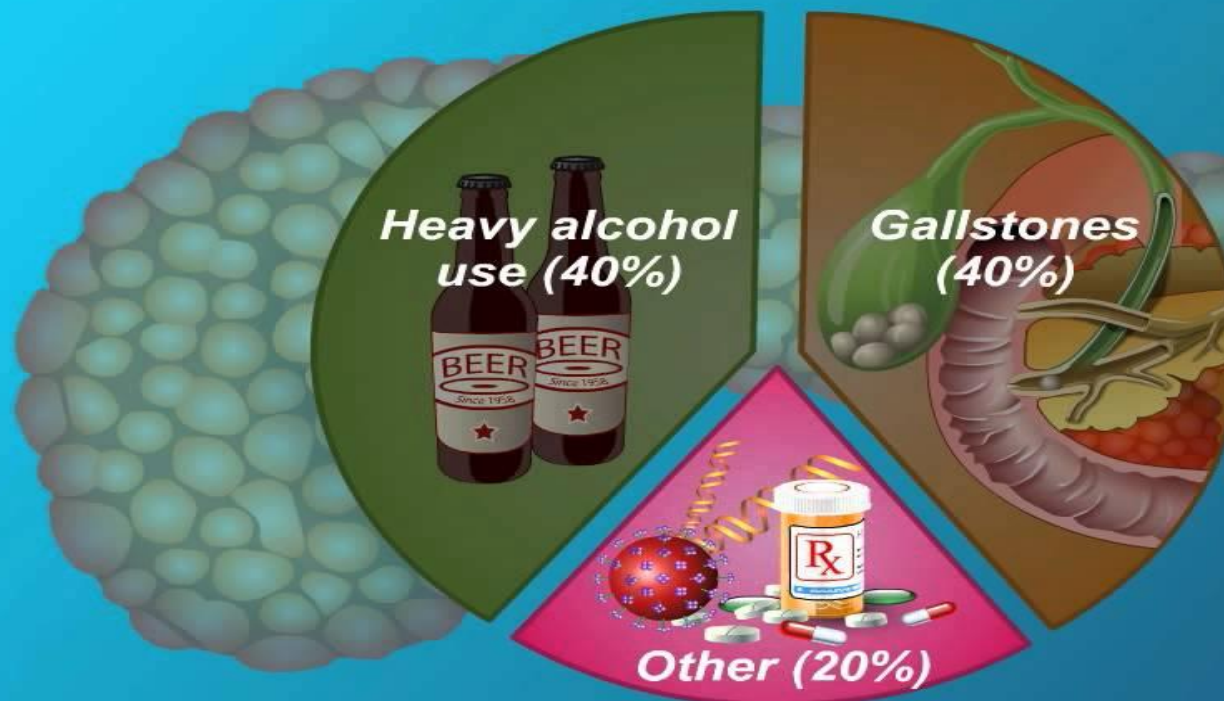
- Diagnosed with Hepatobiliary (HIDA) Scan
 - normal gallbladder ejection fraction is usually over 35%

GALLSTONE PANCREATITIS

- Gallstones are a common cause of pancreatitis. Gallstones, produced in the gallbladder, can block the bile duct, stopping pancreatic enzymes from traveling to the small intestine and forcing them back into the pancreas. The enzymes then begin to irritate the cells of the pancreas, causing the inflammation associated with pancreatitis.

GALLSTONE PANCREATITIS

Causes of acute pancreatitis



Other causes:

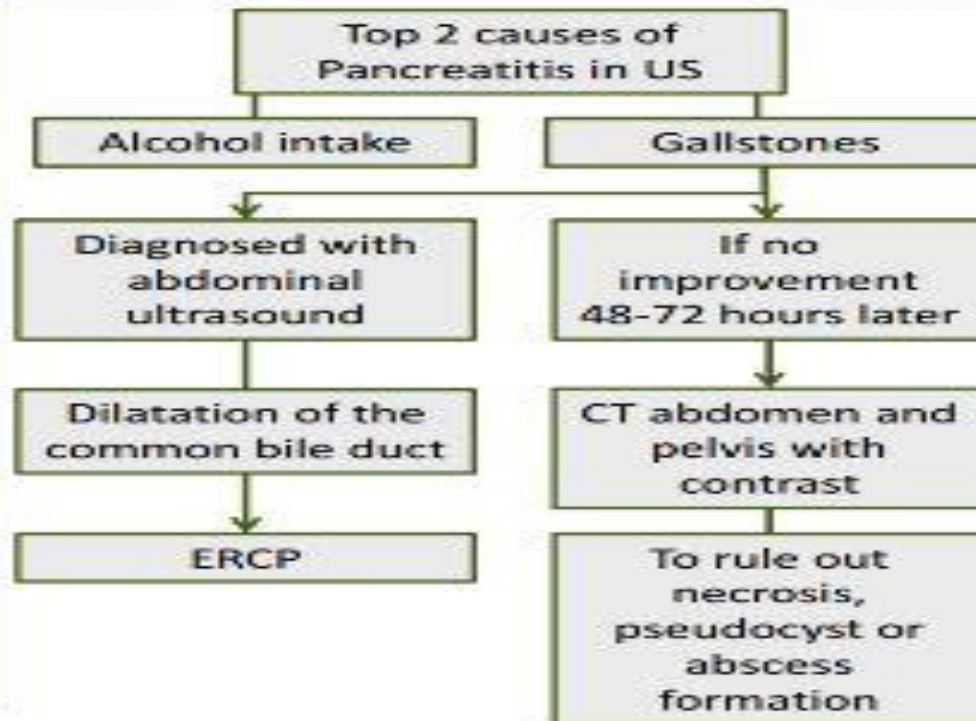
- **Abdominal trauma**
- **Medications**
- **Infections**
- **Tumors**
- **Genetic/anatomical variants**
- **High triglyceride levels**
- **High calcium levels**

GALLSTONE PANCREATITIS

Gallstone Pancreatitis

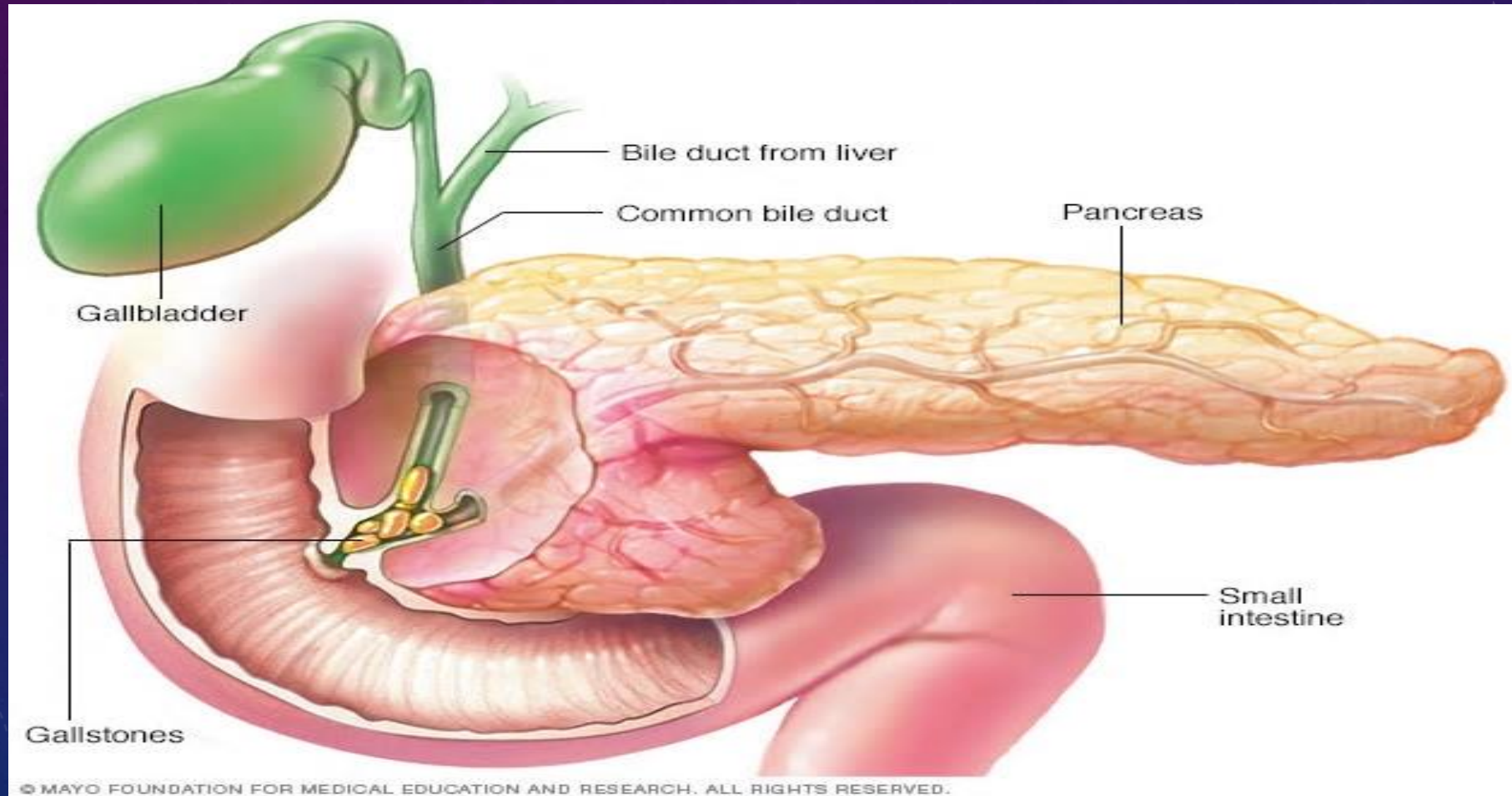


knowmedge



I	IDIOPATHIC
G	GALLSTONES
E	ETHANOL
T	TRAUMA
S	STERIODS
M	MUMPS / MALIGNANCY
A	AUTOIMMUNE
S	SCORPION STING
H	HYPERCALCEMIA/TG>1000
E	ERCP
D	DRUGS

GALLSTONE PANCREATITIS



GALLSTONE PANCREATITIS

Ranson Criteria

Admission

- Age > 55
- WBC > 16,000
- Glucose > 200
- LDH > 350
- AST > 250

During first 48 hours

- Hematocrit drop > 10%
- Serum calcium < 8
- Base deficit > 4.0
- Increase in BUN > 5
- Fluid sequestration > 6L
- Arterial PO₂ < 60

*5% mortality risk with <2 signs
15-20% mortality risk with 3-4 signs
40% mortality risk with 5-6 signs
99% mortality risk with >7 signs*

GALLSTONE PANCREATITIS

- Current recommendations are for cholecystectomy during index admission for pancreatitis
- Await pain resolution and normalization of lab values

RADIOGRAPHIC EVALUATION

- Ultrasound
- CT scan
- Hepatobiliary Scan
- MRI
 - MRCP
- ERCP

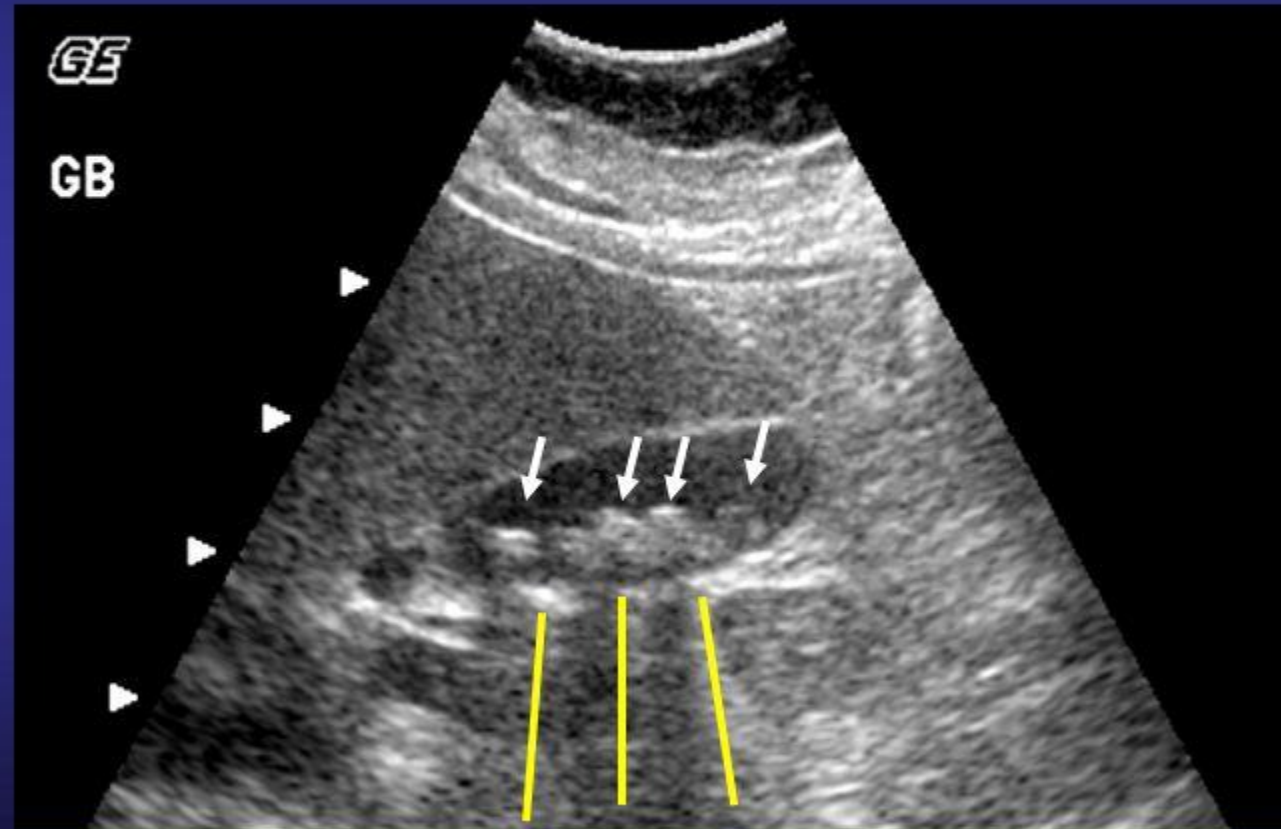
EVALUATION

- Ultrasonography

- Gallstones are suspected in patients with biliary colic. Abdominal ultrasonography is the imaging test of choice for detecting gallbladder stones; sensitivity and specificity are 95%. Ultrasonography also accurately detects sludge. CT, MRI , and oral cholecystography (rarely available now, although quite accurate) are alternatives. Endoscopic ultrasonography accurately detects small gallstones (< 3 mm) and may be needed if other tests are equivocal.

Gallstones

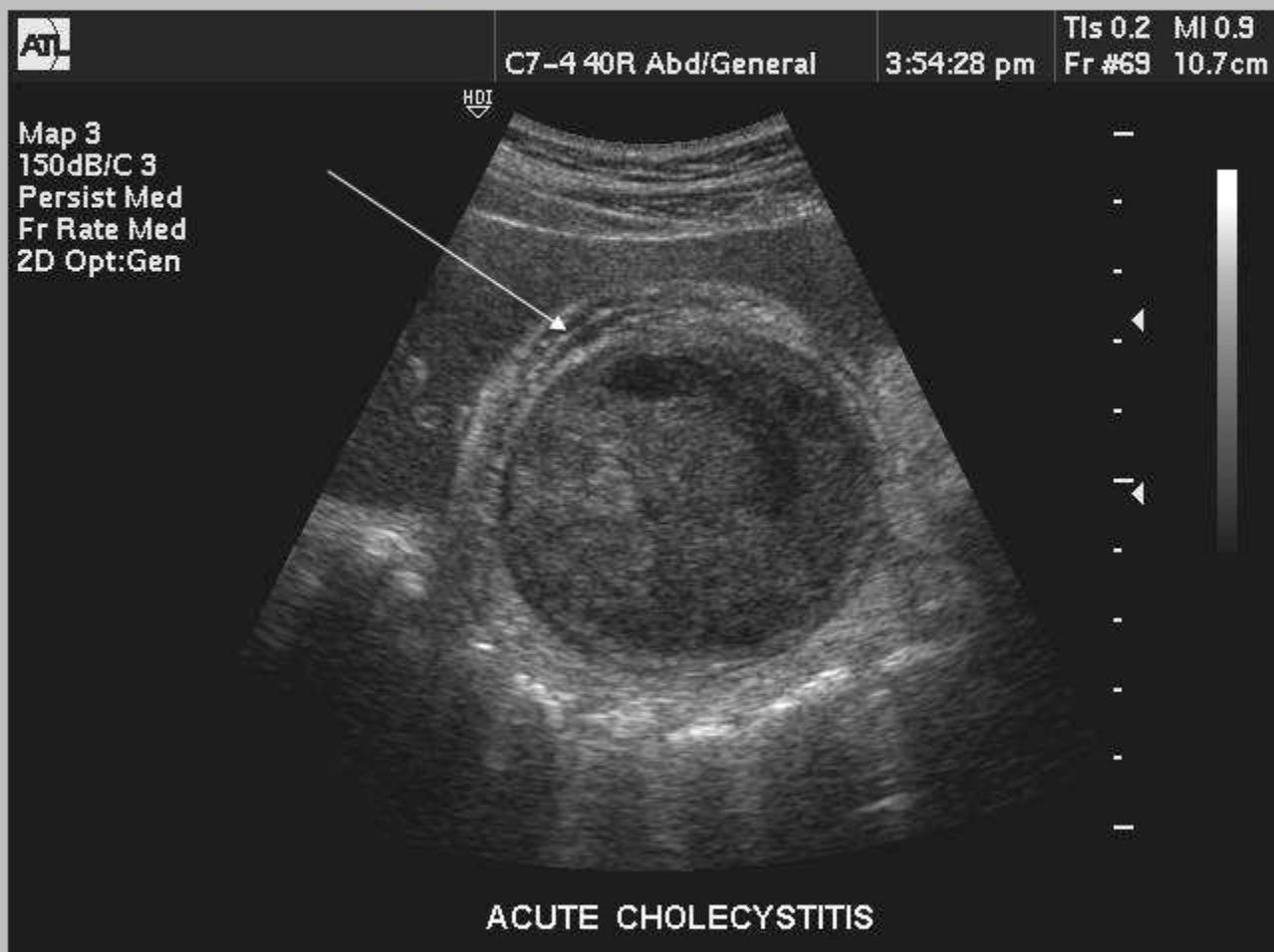
- Ultrasound upper abdomen
- Longitudinal scan
- Round echogenic structures in gallbladder
- Acoustic shadowing





Acute cholecystitis

Ultrasound



Acute gangrenous cholecystitis.

Sonography demonstrates an **anechoic fluid mass** situated in the wall of the gallbladder.

Sonograms shows marked laminated sonolucent thickening of the gallbladder wall, with the lumen of the gallbladder full of sludge.

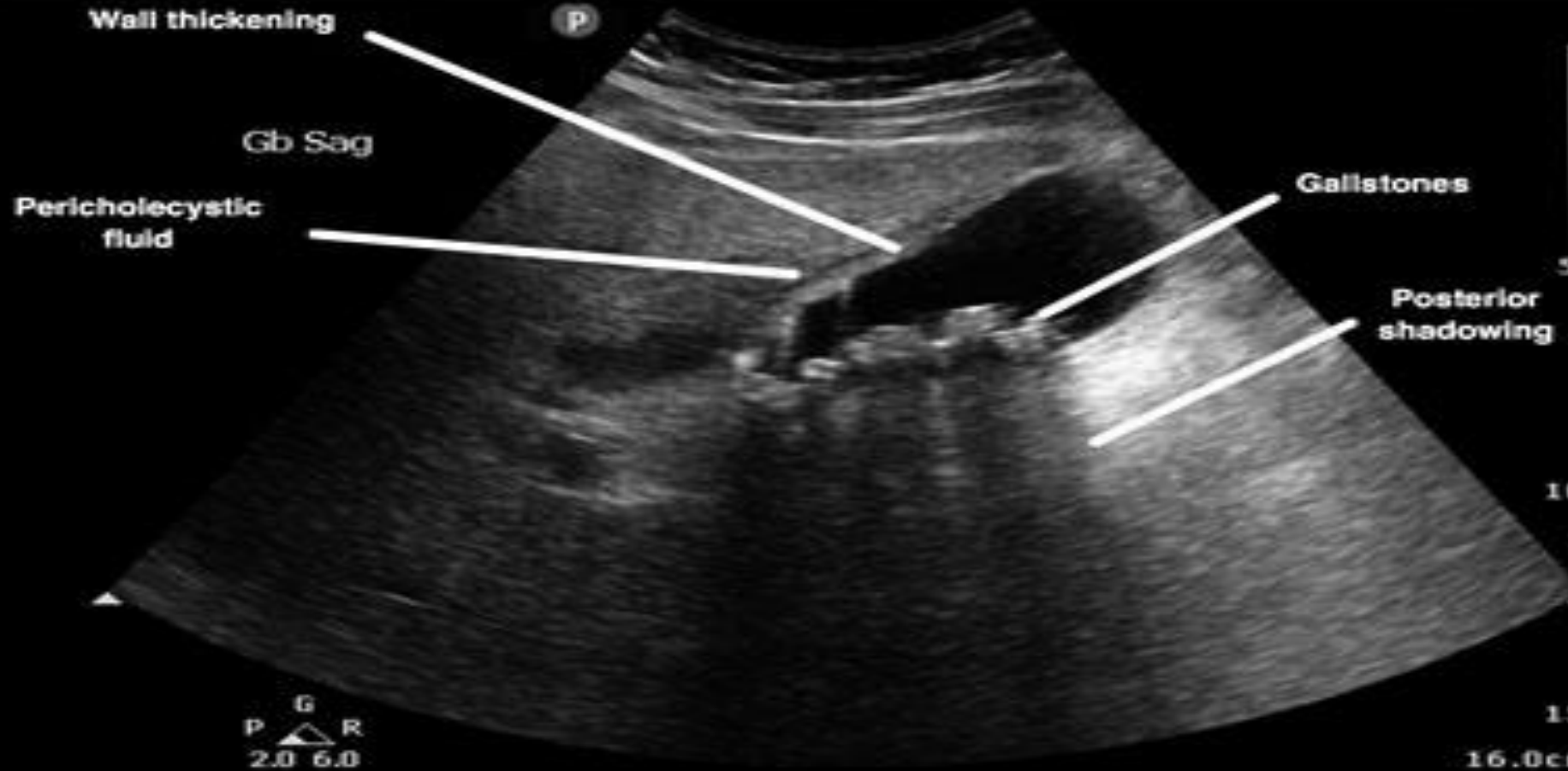
Gallbladder is enlarged

PHILIPS

MI 0.5
TIS 0.1

GBM
C6-2
28Hz
16.0cm

2D
Pen
Gn 58
58
1/3/5



Gangrenous cholecystitis

No specific diagnostic US findings

- **Striated thickening of GB wall**
- **Intraluminal membranes (5%)**
- Marked asymmetry of GB wall
- Echogenic debris within GB
- Pericholecystic fluid collections
- US Murphy's sign negative in 70%



Mucosal sloughing
Echogenic debris within GB

CT SCAN

- In most cases, CT scan is not used to detect gallstones, but this imaging test does have its uses in the biliary system. First of all, the entire main duct can be seen using CT scan because unlike ultrasound, air in the GI tract does not interfere with CT. High-speed CT with computer-assisted reformatting capabilities allows the radiologist to move quickly through numerous images. The ability of CT to find stones in the common bile duct approximates ultrasound. In general, CT scan is a better test for more complicated problems, although it may be used together with ultrasound.

Gallstones

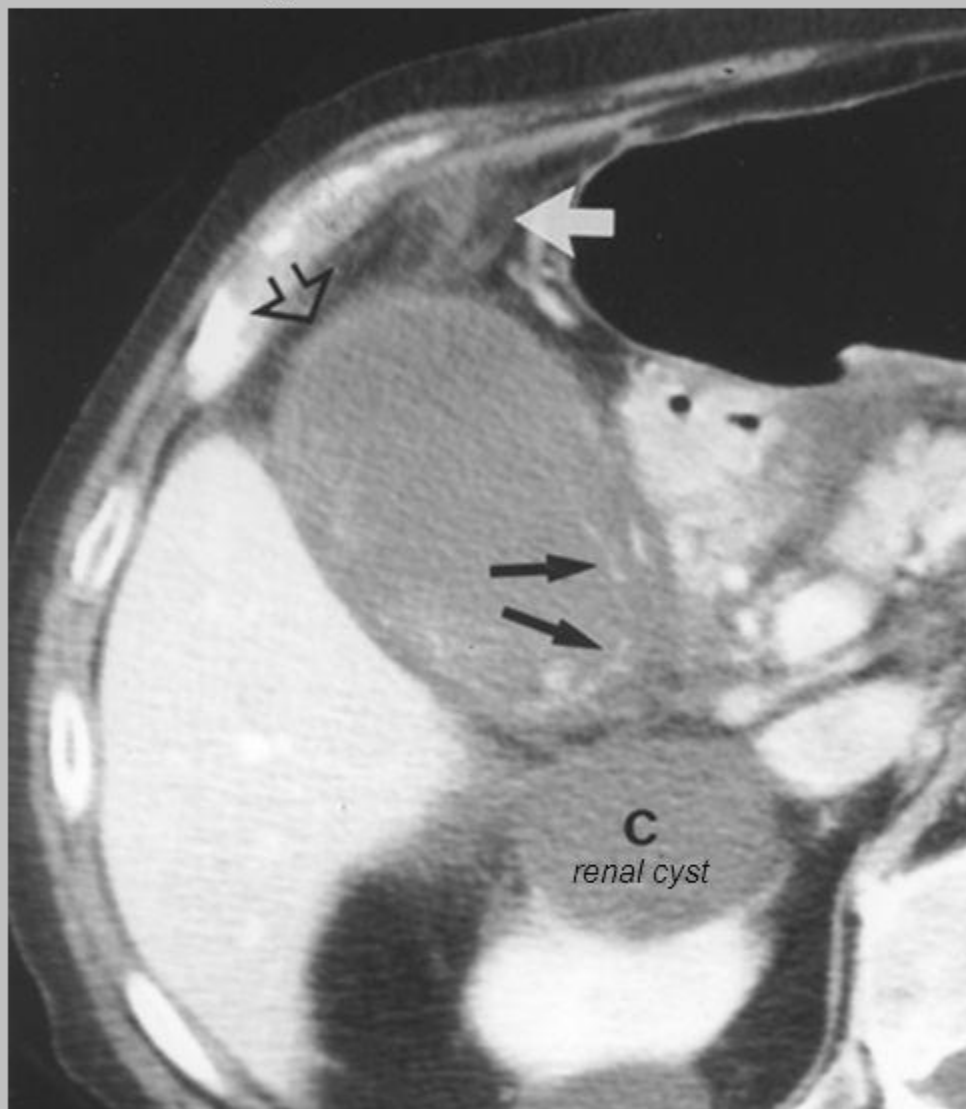






Acute cholecystitis

CT Findings



Acute gangrenous cholecystitis.

CT scan with IV contrast material shows **intraluminal linear densities** corresponding to intraluminal membranes.

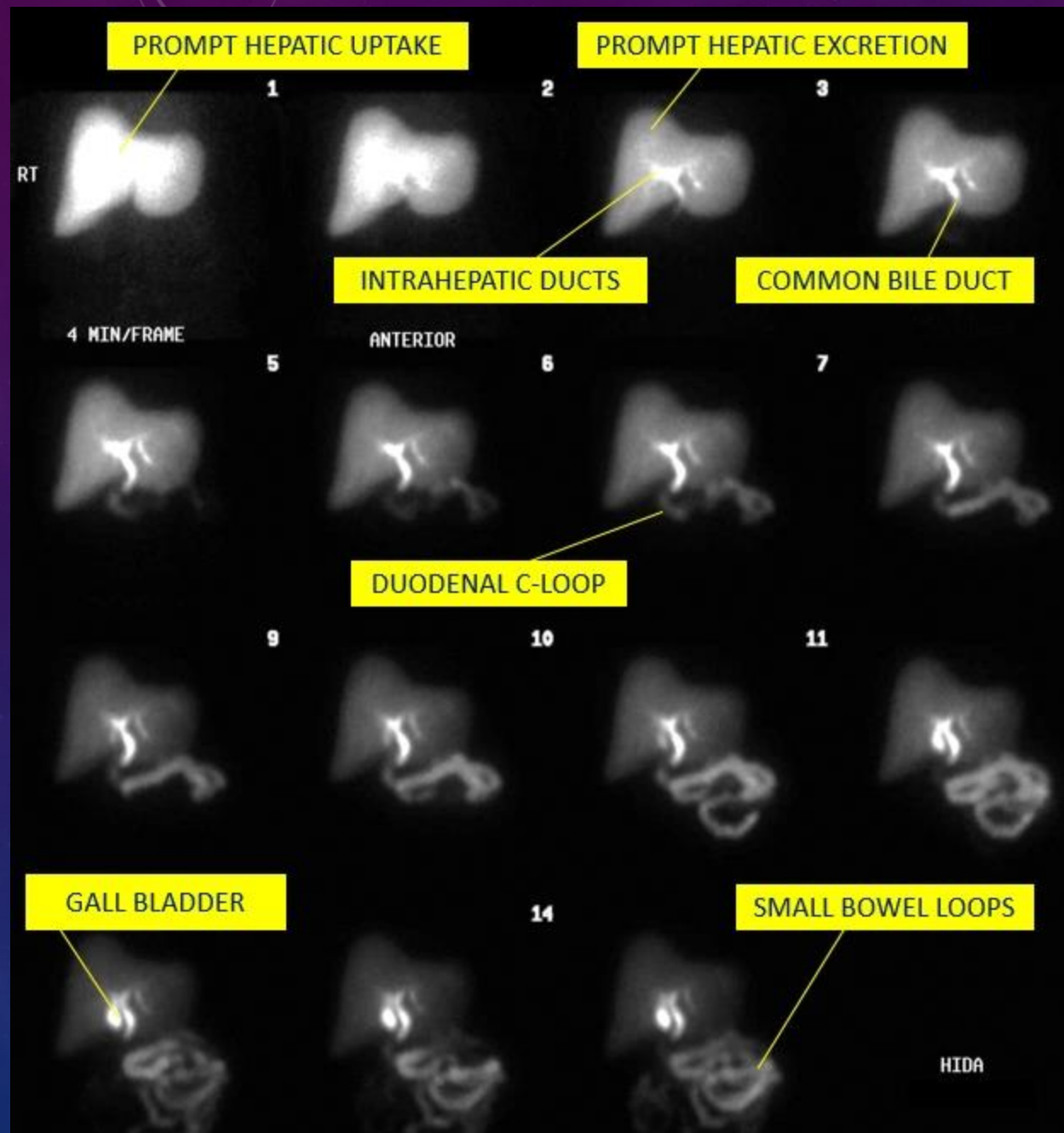
Note **lack of contrast enhancement** of gallbladder wall and **pericholecystic inflammation**.

HEPATOBIILIARY SCAN

- Cholescintigraphy or hepatobiliary scintigraphy is scintigraphy of the hepatobiliary tract, including the gallbladder and bile ducts. The image produced by this type of medical imaging, called a cholescintigram, is also known by other names depending on which radiotracer is used, such as HIDA scan, PIPIDA scan, DISIDA scan, or BrIDA scan. Cholescintigraphic scanning is a nuclear medicine procedure to evaluate the health and function of the gallbladder and biliary system. A radioactive tracer is injected through any accessible vein and then allowed to circulate to the liver, where it is excreted into the bile ducts and stored by the gallbladder until released into the duodenum.

HEPATOBIILIARY SCAN

- A normal gallbladder ejection fraction is usually over 35%. Anything less than this would be considered dysfunction of the gallbladder or biliary dyskinesia.



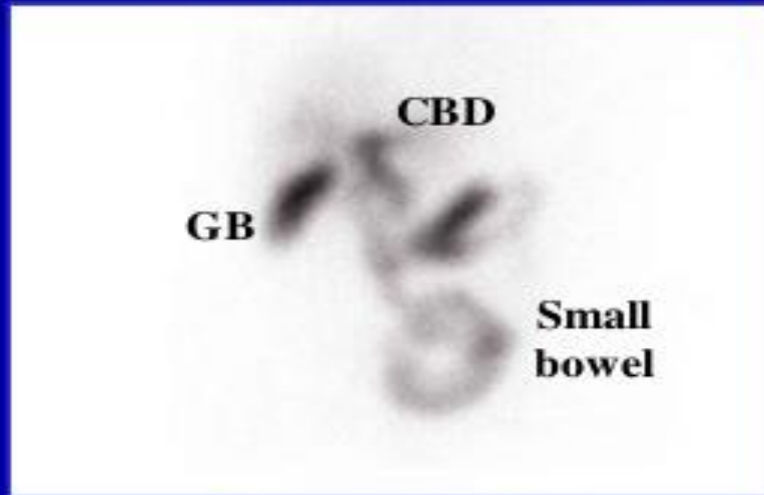
HIDA SCAN

- **Interpretation**
- **A normal** result means that the gallbladder is visualized **within 1 hour** of the injection and the tracer is in the small intestine.
- **GB not visualized:** If the gallbladder is not visualized within 4 hours after the injection it indicates that there is either cholecystitis or cystic duct obstruction.
- **Tracer not visualized in intestines** means common bile duct obstruction. If the radioactive tracer moves through bile ducts very slowly, this may indicate a blockage or obstruction. Or it may indicate a problem in liver. .
- If the radioactive **tracer is found outside of biliary system** it indicates a leak.
- **Uptake is poor** in parenchymal liver disease, such as neonatal hepatitis, but **excretion into the bile and intestine eventually ensues.**

Acute cholecystitis – HIDA scan

Higher accuracy than ultrasonography

Normal HIDA scan

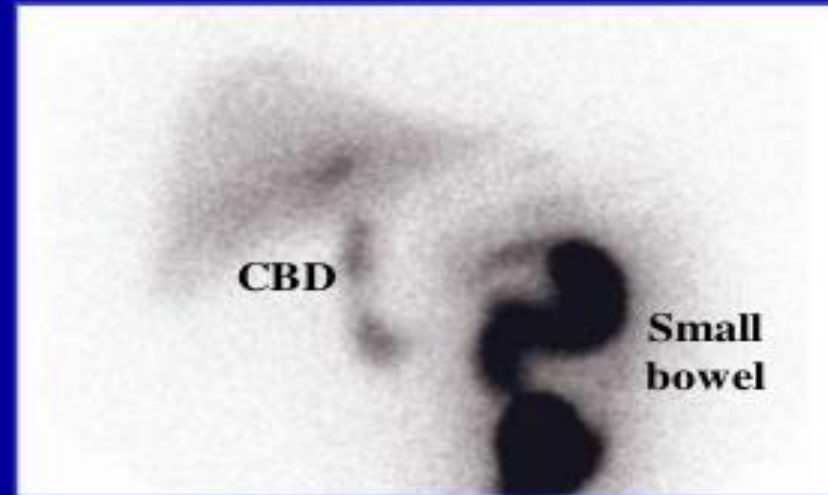


Tracer in GB

Tracer in CBD

Tracer in small bowel

Acute cholecystitis



Non-filling of GB

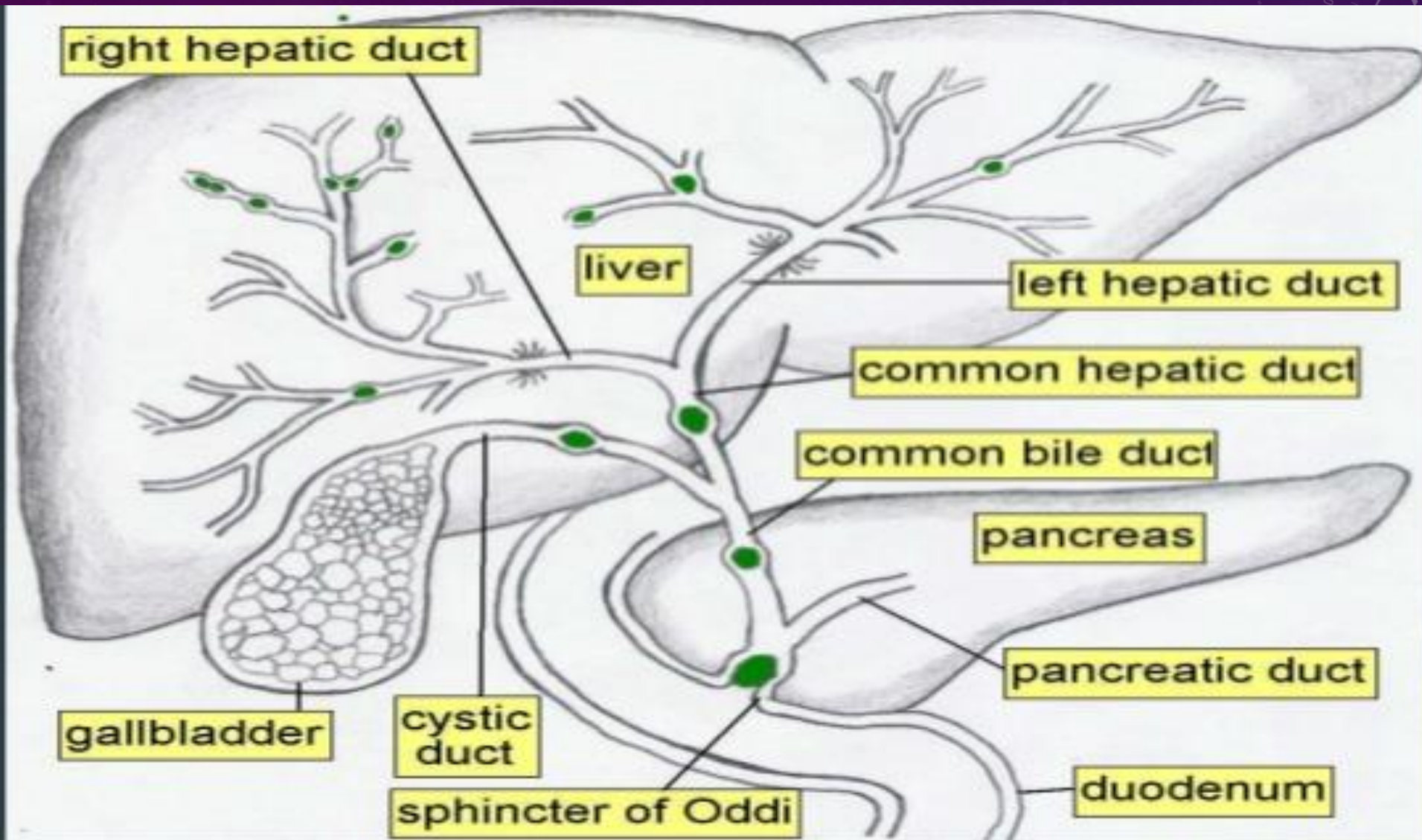
Tracer in CBD

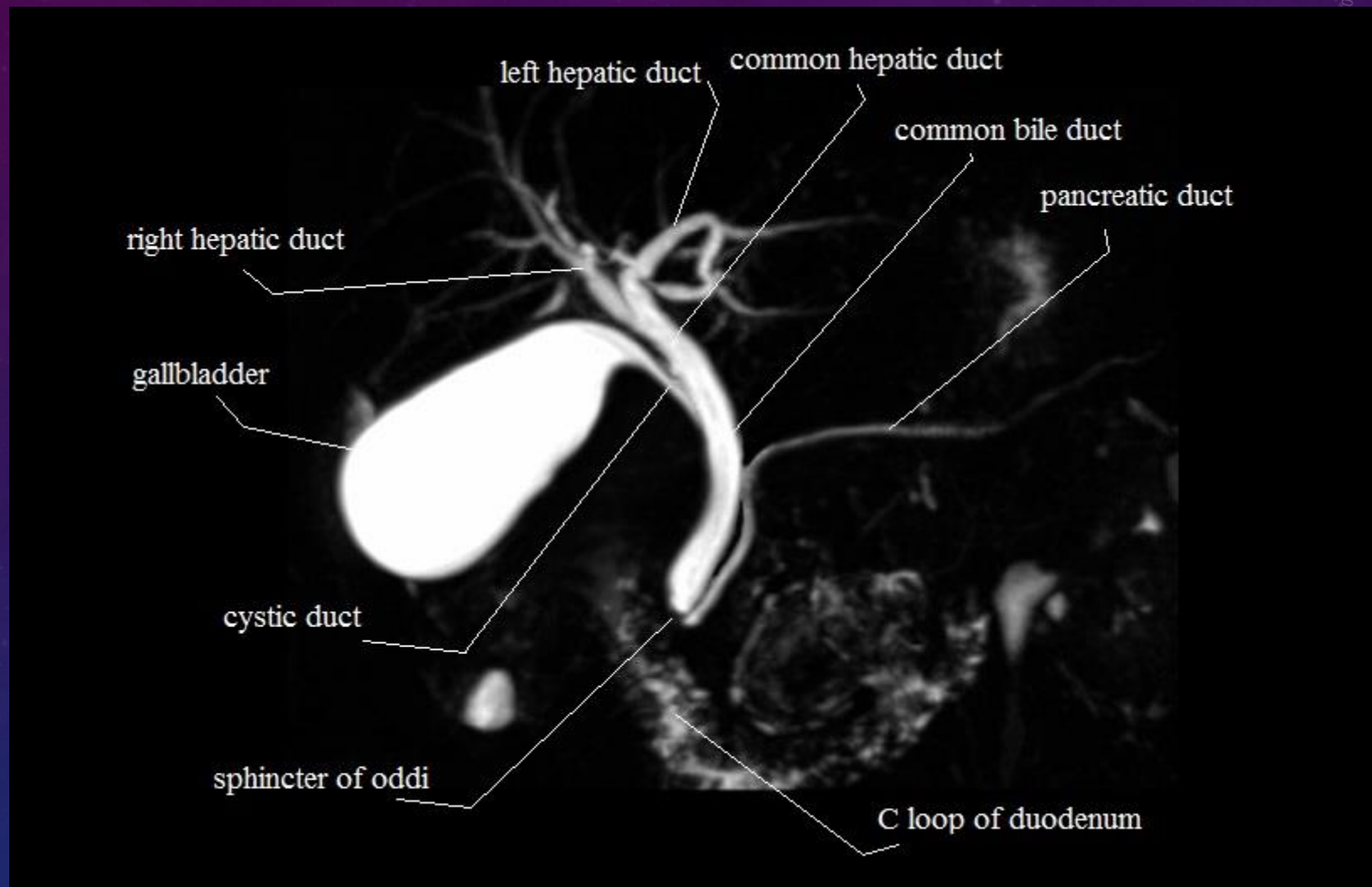
Tracer in small bowel

Talley NJ et al. Practical gastroenterology & hepatology: Liver & biliary disease.
Wiley Blackwell, Oxford, UK, First edition, 2010.

MRCP

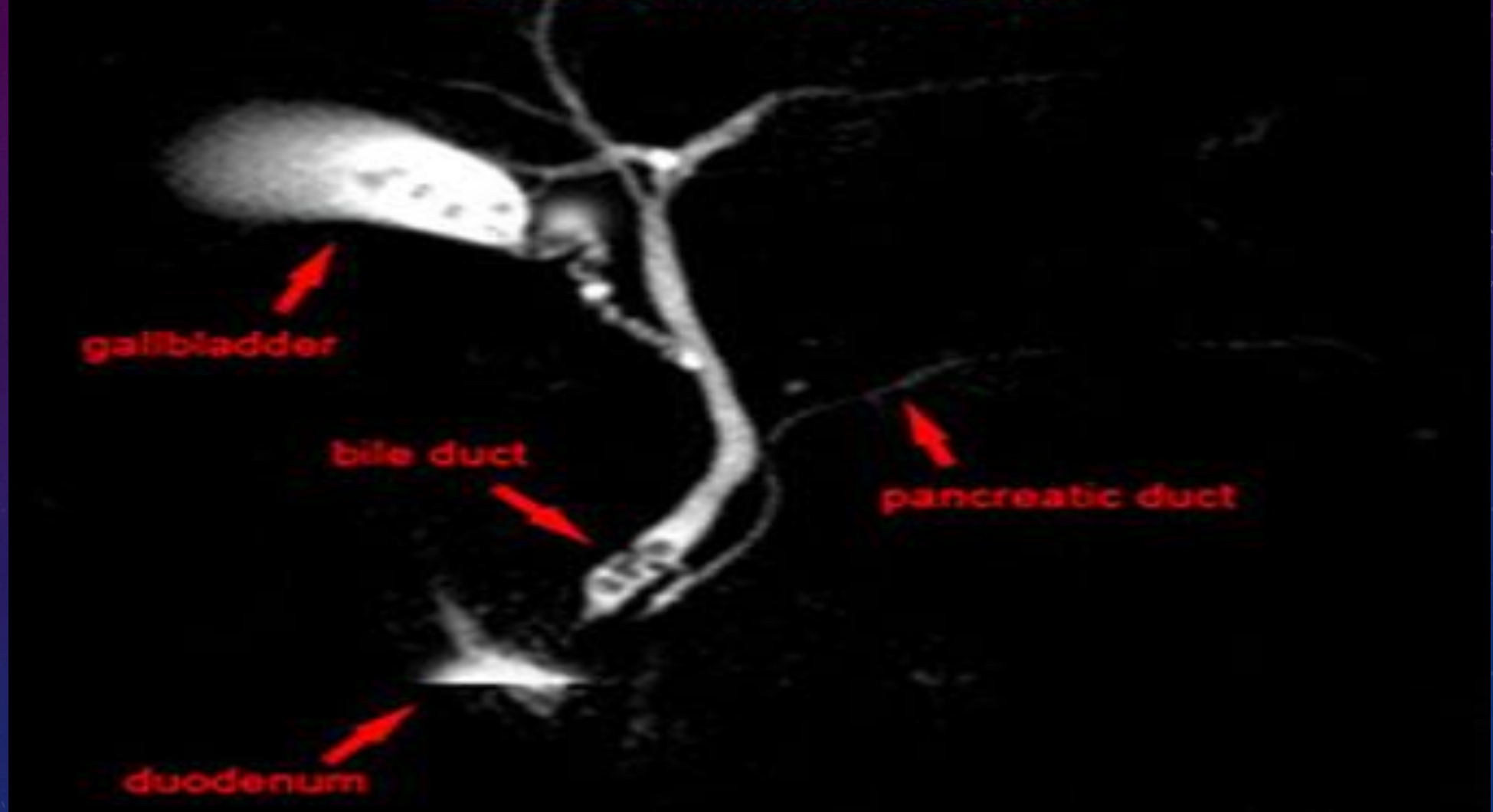
- Magnetic resonance cholangiopancreatography (MRCP) is a medical imaging technique that uses magnetic resonance imaging to visualize the biliary and pancreatic ducts in a non-invasive manner. This procedure can be used to determine if gallstones are lodged in any of the ducts surrounding the gallbladder.





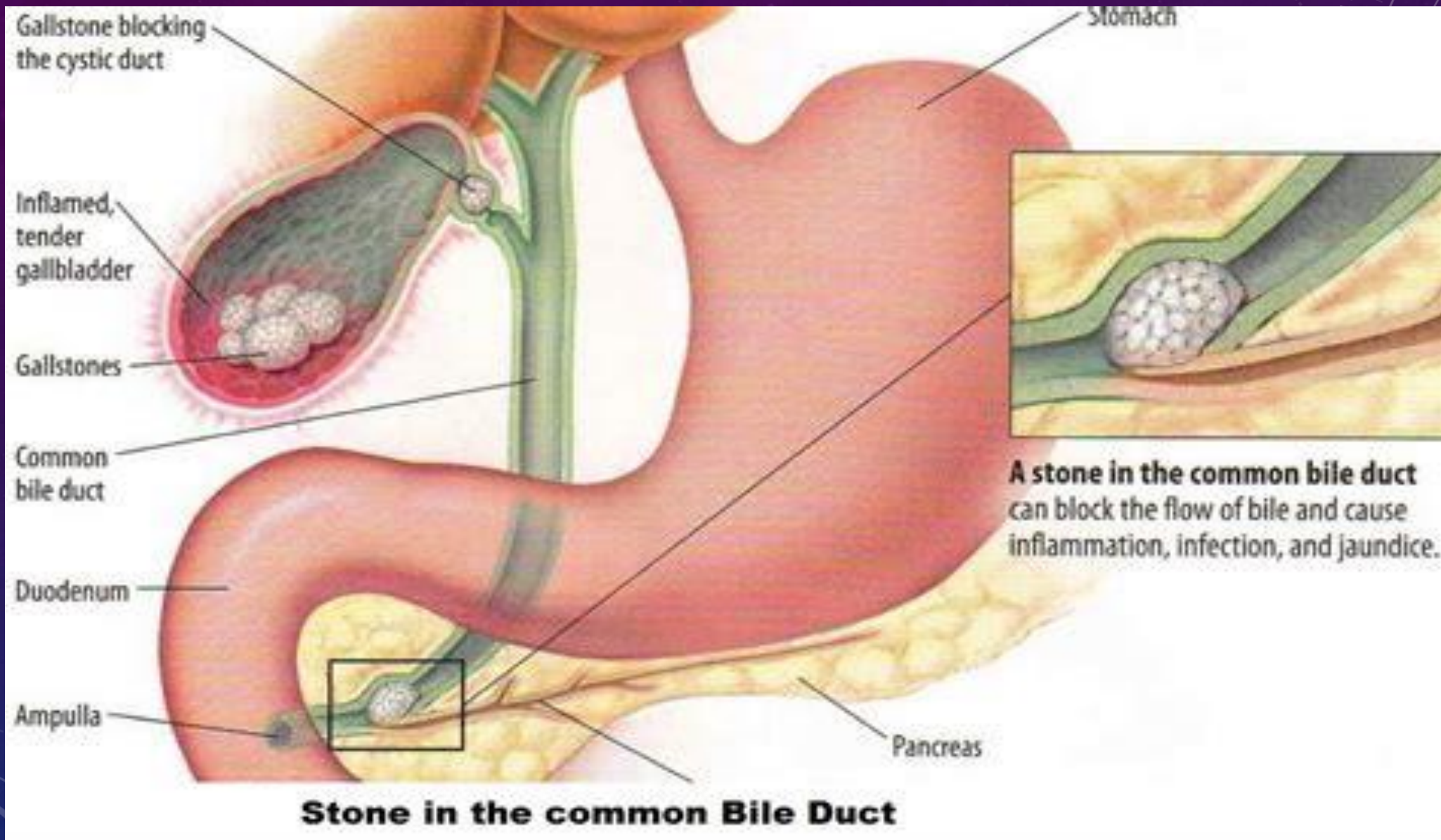


MRCP Image Showing Stones In Distal Common Bile Duct

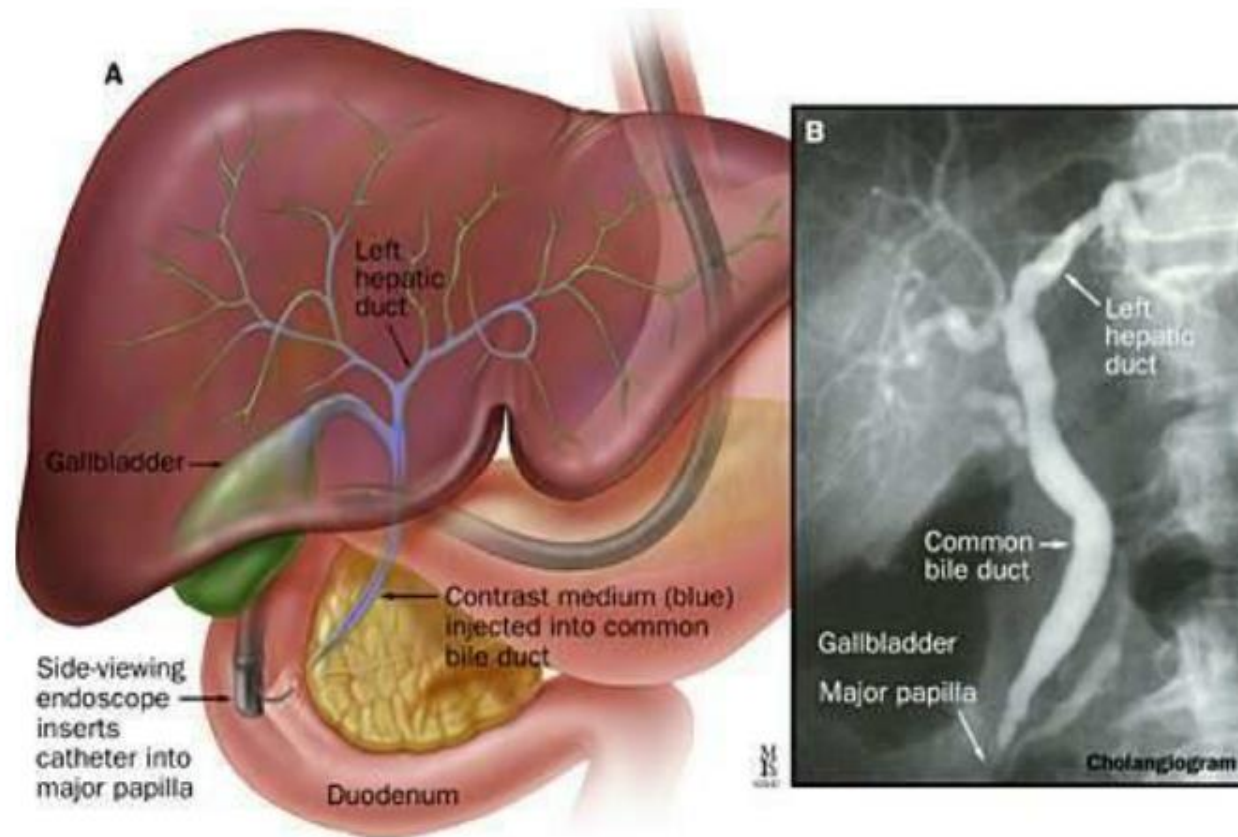


ERCP

- Endoscopic retrograde cholangiopancreatography is a technique that combines the use of endoscopy and fluoroscopy to diagnose and treat certain problems of the biliary or pancreatic ductal systems. Through the endoscope, the physician can see the inside of the stomach and duodenum, and inject a contrast medium into the ducts in the biliary tree and pancreas so they can be seen on radiographs.



ERCP :Endoscopic Retrograde Cholangiopancreatography





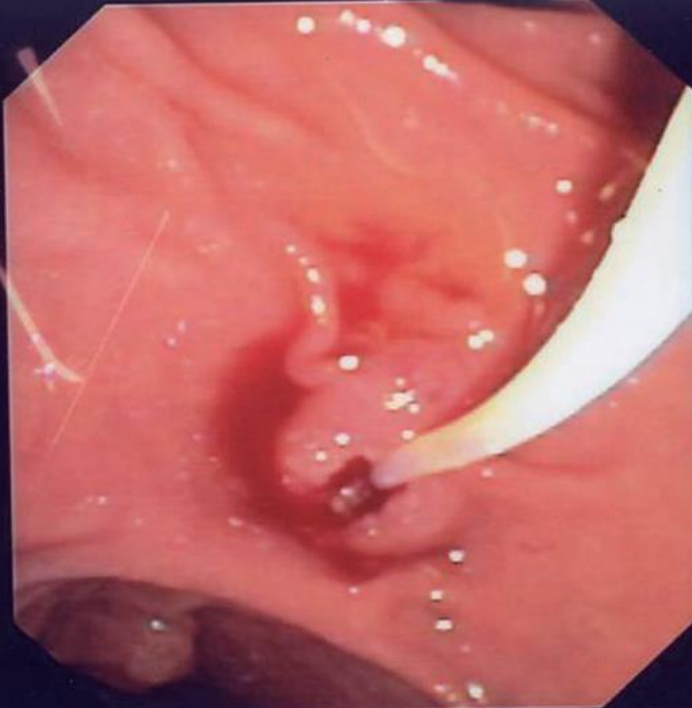
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Physician:
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ID. No. :I
Name :

Sex: Age:
D. O. Birth:

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TREATMENT

- Cholecystectomy
 - Open
 - Laparoscopic
 - Multiport vs SILS

CHOLECYSTECTOMY

- Over 500,000 minimally invasive cholecystectomies are performed annually, with the majority being removed through a laparoscopic approach. This is the procedure of choice for patients with asymptomatic, symptomatic, and most forms of complicated gallbladder disease.

CHOLECYSTECTOMY

- Laparoscopic is the gold standard
- 90% of cholecystectomies performed this way
- Decreased post-op pain, better cosmesis, decreased hospital stay and disability
- HOWEVER:
 - There remains an increased serious complication rate for laparoscopic approach

INDICATIONS FOR SURGERY

- Symptomatic cholelithiasis, with or without complications
- Asymptomatic cholelithiasis with increased risk for gallbladder CA or gallstone complications
- Acalculous cholecystitis
- Gallbladder polyps $>0.5\text{cm}$
- Porcelain gallbladder

LAPAROSCOPIC CHOLECYSTECTOMY

- **Relative Contraindications**

Previous abdominal surgery in epigastrium or right-upper quadrant

End-stage liver disease

Cholecystenteric fistula (e.g. gallstone ileus)

Mirizzi's syndrome (Type II)

Calcified gallbladder wall (e.g. porcelain gallbladder)

- **Absolute Contraindications**

Known invasive gallbladder carcinoma

Uncorrected coagulopathy

Inability to tolerate general anesthesia or laparotomy

PREOPERATIVE EVALUATION

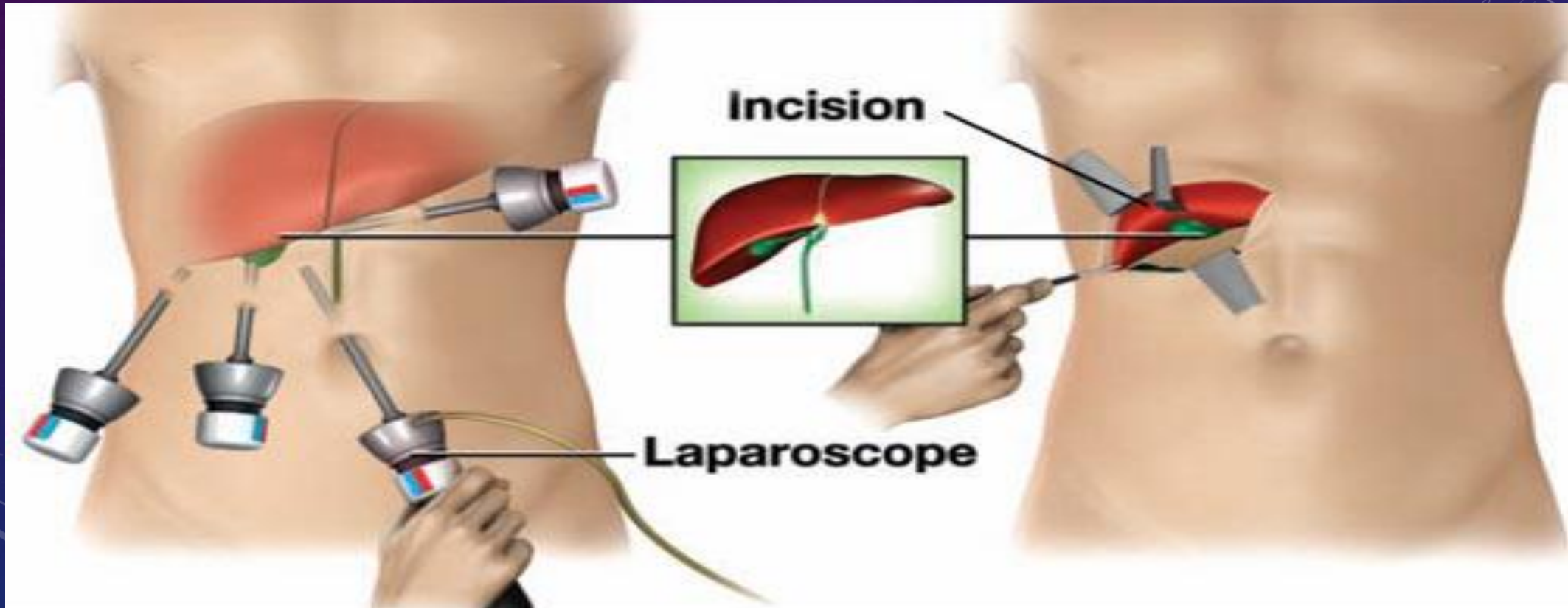
- LABS:

- CBC, COMPLETE METABOLIC PANEL, AMYLASE, LIPASE

- RADIOLOGY:

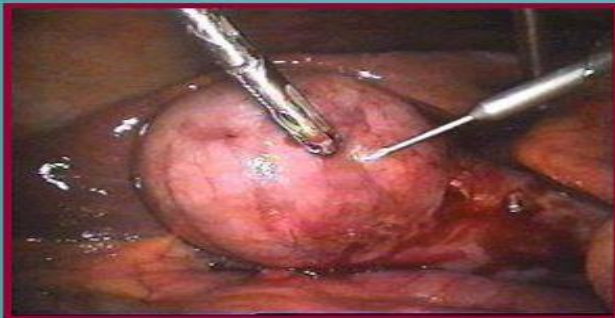
- US, CT, MRCP, ERCP as indicated for individual case

LAPAROSCOPIC CHOLECYSTECTOMY

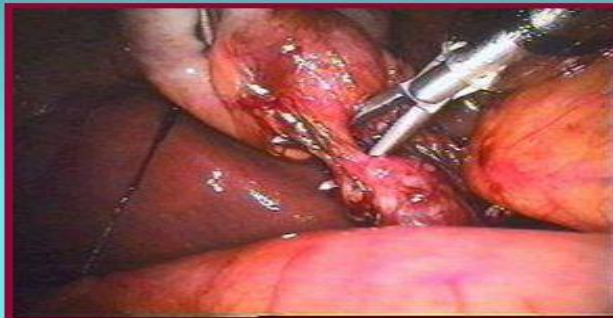


LAPAROSCOPIC CHOLECYSTECTOMY

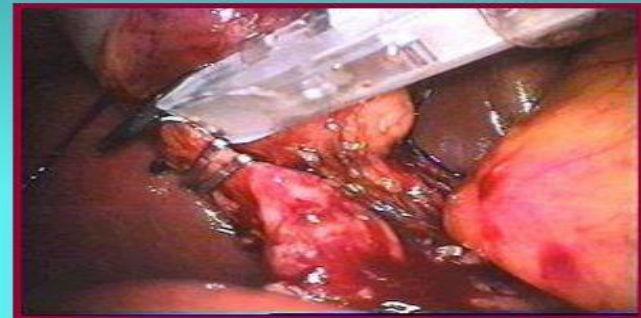
Laparoscopic cholecystectomy



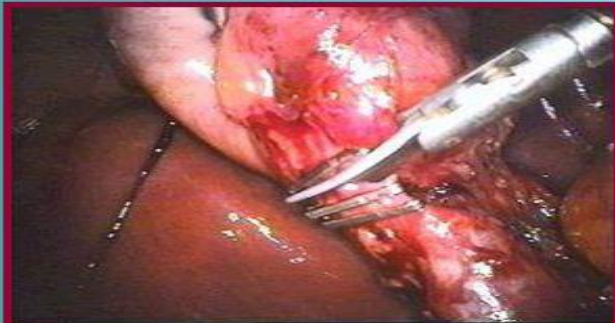
Puncture of the gall bladder



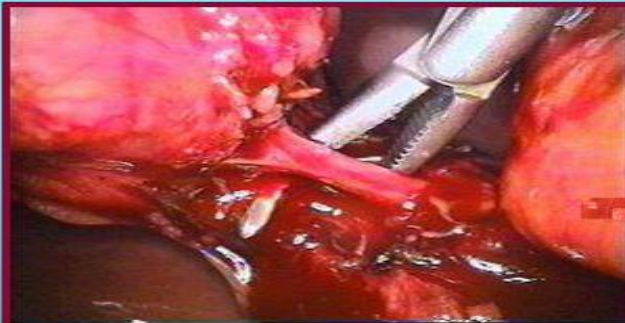
Select items



Clipping



The intersection of the cystic duct



Isolation of arterial



Cholecystectomy

OPEN CHOLECYSTECTOMY

- Conversion:
 - Hemorrhage, unusual or confusing anatomy, failure to progress laparoscopically, bowel perforation or bile duct injury, potentially resectable gallbladder CA
- Conversion rates of 2.6% to 14% had been described in literature.

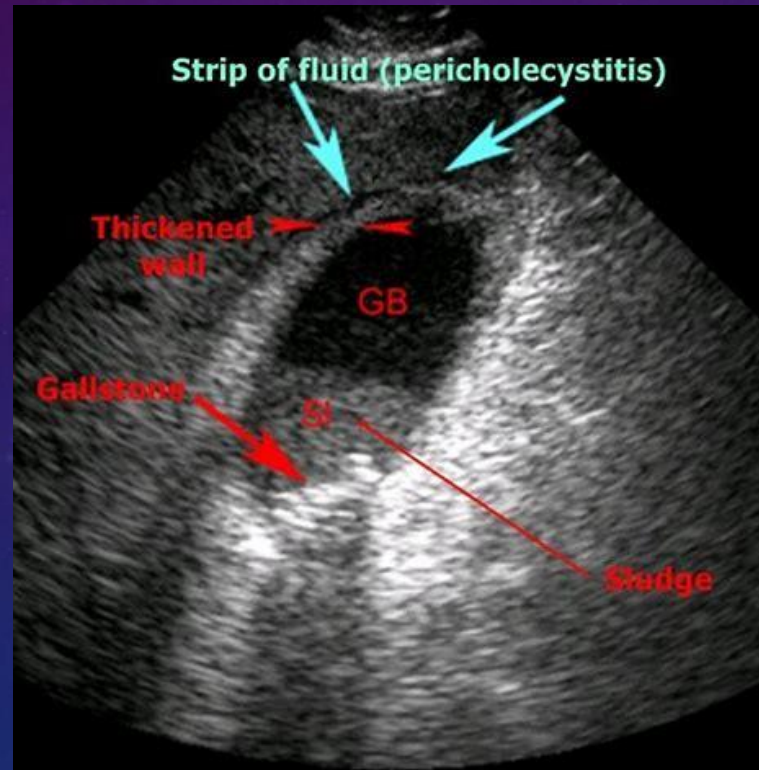
CASE #1

- A forty two year-old woman presents to the emergency department complaining of abdominal pain, nausea and vomiting. She notes she has had prior similar episodes which resolved spontaneously however the pain today has persisted for five hours and is much more severe. The pain is located in the right upper quadrant of her abdomen and radiates to her upper back. She describes the pain as dull and cramping. The patient's vital signs are as follows: BP 148/96, P108, R18, T99.9. She has a history of hypertension and is overweight.

CASE #1

- On exam, you note the patient has right upper quadrant abdominal tenderness and guarding. Murphy's Sign (a pause with inspiration on palpation of the right upper quadrant) is positive. Based on the patient's symptoms you order labs including a CBC, CMP, amylase, lipase, urinalysis, urine Hcg as well as an ultrasound of the patient's gallbladder.

CASE #1





• QUESTIONS?