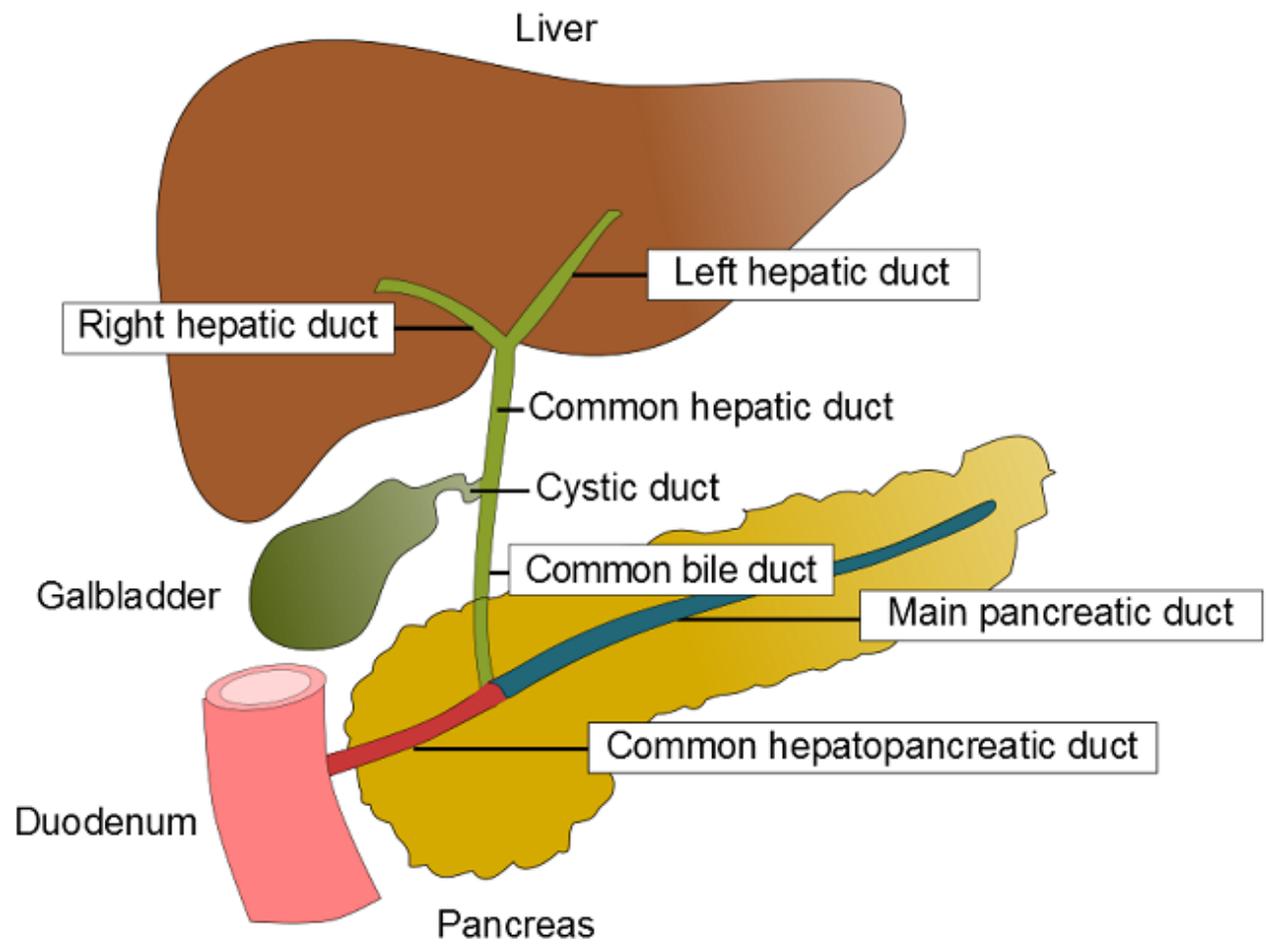


# Jaundice

- The complexity of the biliary tree can be broken down into much simpler segments. The intrahepatic ducts converge to form the right and left hepatic ducts which exit the liver and join to become the common hepatic duct. The cystic duct branches off the common hepatic duct and drains into the gallbladder.
- The common hepatic duct continues towards the duodenum, but it is called the common bile duct (CBD) after the take-off of the cystic duct. The CBD then joins the pancreatic duct prior to draining into the second portion of the duodenum.

- Obstruction, inflammation, or infection of the biliary tract changes the baseline anatomy and size of the various ducts. The normal calibers of the CBD and pancreatic duct are  $< 8\text{mm}$  and  $< 4\text{mm}$ , respectively. The gallbladder wall is typically  $< 4\text{mm}$  in thickness.



- Patients with obstructive jaundice are inclined to develop nutritional deficits, infectious complications, acute renal failure, and impairment of cardiovascular function. Adverse events such as coagulopathy, hypovolemia, and endotoxemia can be insidious and significantly increase mortality and morbidity.
- Postoperative morbidity of patients with obstructive jaundice is up to about 20–30%.The anesthesiologist and critical care team play a crucial role in the perioperative management of such patients.

- Choledocholithiasis undoubtedly is the leading cause of biliary obstruction, although malignancies such as cholangiocarcinoma, periampullary and pancreatic cancers, and benign stricture including chronic pancreatitis have become increasingly prevalent.

- Jaundice is the yellowing of the skin and sclera due to abnormally elevated levels of bilirubin in the blood. It can be characterized into three different categories including pre-hepatic, intra-hepatic, or post-hepatic. Pre-hepatic and intra-hepatic causes are known as medical jaundice, while post-hepatic (or obstructive jaundice) is considered surgical jaundice.



## PRE-HEPATIC :

In pre-hepatic jaundice, there is ***excess production*** of bilirubin that overtakes the ability of liver to conjugate the bilirubin and excrete into the gut. This is predominantly ***unconjugated hyperbilirubinemia***. The most common cause of pre-hepatic jaundice is hemolytic anemia which causes excess heme breakdown.

## INTRA-HEPATIC:

Intra-hepatic causes are due to parenchymal liver disease with inability to either conjugate or excrete bilirubin. In this case, the fraction of bilirubin that is elevated varies. Viral hepatitis often has a predominantly unconjugated bilirubinemia. A conjugated hyperbilirubinemia is seen with cholestasis from drugs or primary biliary cholangitis.

## POST-HEPATIC :

In post-hepatic jaundice or ***obstructive jaundice***, there is an impediment to the flow of bile due to a partial or complete obstruction of the extrahepatic biliary passage between the liver and duodenum. Obstruction can occur within the biliary ducts themselves or more distal within the pancreas. This is predominantly a ***conjugated hyperbilirubinemia***.

- Careful history-taking, clinical examination and investigations point to the cause of jaundice
- Serum biochemistry confirms the diagnosis of jaundice with an elevated serum bilirubin, usually  $\geq 40 \mu\text{mol/l}$  when detectable clinically.
- An obstructive pattern is recognizable in the other liver function tests i.e. a high alkaline phosphatase and only mild increase in the concentration of transaminases.

## Presentation of jaundice

	<b>Stones in common bile duct</b>	<b>Malignancy</b>	<b>Drug-induced cholestasis</b>	<b>Acute viral hepatitis</b>
<b>History</b>	Dyspepsia, biliary colic	Nil	Drug history (present and last 6/12 months)	Transfusions, injections, contacts
<b>Pain</b>	Colic, epigastric to back (episodic), none	Epigastric to back (constant), none	None	Discomfort in right upper quadrant, none
<b>Weight loss</b>	Slight±	Remorseless, none	Slight±	Slight±
<b>Pruritis</b>	±	+	+	Transient
<b>Investigations</b>				
Bilirubin (serum; mmol/l)	50–150	Steady rise to >200	Variable	Variable
Urobilinogen (urine)	+	–	–early	–early (+late)
Alkaline phosphatase (serum; × normal)	>3×	>3×	>3×	<3×
Aspartate aminotransferase (serum; × normal)	<5×	<5×	>5×	>10×
White cell count (differential)	1/Normal (1polymorphs)	1/Normal	Normal	1(Lymphocytes)
Ultrasound	Gallstones ± dilated ducts	Dilated ducts ± mass/stricture	Normal	Splenomegaly

# Obstructive (Surgical) Jaundice

- Surgical jaundice is suspected over medical jaundice in the following scenarios:
- History of abdominal pain and fevers
- Painless jaundice with weight loss, pruritus, and clay colored stools
- Conjugated bilirubinemia with elevation of alkaline phosphatase and GGT
- An enlarged gallbladder, abdominal mass, and/or lymph node in left supraclavicular area is considered advanced disease

- Distinguishing surgical jaundice from medical jaundice is just the first step in the diagnosis and treatment. Post-hepatic obstruction can be located in several different areas of the biliary tree and can be due to a variety of benign and malignant pathologies outlined below.

- Benign:
- Choledocholithiasis
- Mirizzi syndrome
- Bile duct stricture
  - *Chronic pancreatitis*
  - *Primary sclerosing cholangitis*
- Choledochal cyst

- **Malignant:**
- Pancreatic
  - *Solid*
  - *Cystic*
- Cholangiocarcinoma :*Klatskin tumor*
- Ampulla of Vater
- **Pediatric:**
- Biliary atresia
- **Iatrogenic:**
- CBD injury following laparoscopic cholecystectomy
- Ischemic stricture from cautery or hepatic artery injury

- Distinguishing between medical jaundice (pre- and intra-hepatic) and surgical jaundice (post-hepatic or obstructive) can be difficult. It is extremely important to obtain a thorough history and physical to help distinguish the underlying pathophysiology of the jaundice.
- HISTORY ?
- EXAM?
- INVESTIGATION?

- Risk factors for gallstones and possible choledocholithiasis are important to obtain.
- This includes obesity, female gender, and age more than 40 years. Prior intraabdominal pathology should be identified, including a history of inflammatory bowel disease, which can have associated hepatic steatosis, cholelithiasis, or primary sclerosing cholangitis.
- A history of pancreatitis should be noted as this can lead to biliary strictures. Any iatrogenic interventions such as surgery or endoscopy are critical to obtain.

# PHYSICAL EXAMINATION

- A thorough but focused physical exam can also help narrow the possible causes of jaundice. This should include a general, abdominal, and rectal exam. The overall general exam allows the clinician to determine the severity of the illness, and the urgency of intervention and level of care required. Also noted on the general exam is jaundice (or icterus) itself. This is defined as the yellowing of skin and whites of the eye (scleral icterus) that accompanies high levels of bilirubin and is typically seen when the levels are greater than 2-3 mg/DL.

- A palpable gallbladder, mass in the abdomen or lymph nodes in the supraclavicular area (Virchow's node) are suggestive of a malignancy causing obstructive jaundice. Stigmata of liver failure or portal hypertension such as caput medusa, spider nevi, and ascites are suggestive of a chronic parenchymal liver disease and an intra-hepatic cause of jaundice.

- ***Charcot's triad***
- - Right upper quadrant pain
- - Jaundice
- - Fever

- ***Reynold's Pentad***
- - Right upper quadrant pain
- - Jaundice
- - Fever
- - Hypotension
- - Altered mental status

- ***Courvoisier's sign/law***
- - Enlarged, non-tender, and palpable gallbladder in patients with obstructive jaundice due to tumors of the biliary tree or pancreatic head
  
- ***Murphy's sign***
- - Positive if patient experiences RUQ tenderness and stops breathing upon inspiration as the gallbladder moves down in contact with the examiner's hand
- - Suggestive of acute cholecystitis

- ***Scleral icterus***
- - Yellowing of the “white of the eye” due to excessive bilirubin in the bloodstream
  
- ***Caput medusae***
- - Distended and engorged superficial epigastric veins which appear to be radiating from the umbilicus across the abdomen due to portal hypertension
  
- ***Rectal varices***
- - Dilation of submucosal vessels and backflow in the veins of the rectum as the blood shunts from the portal system to the systemic venous system due to portal hypertension

# LABORATORY TESTS

- Following history and physical exam, laboratory tests should be the next step in proper diagnosis of jaundice. Obstructive jaundice has hallmark findings on the biochemistry profile. It is primarily a conjugated hyperbilirubinemia with the direct bilirubin > 50% of the total bilirubin. There is also an associated elevation of alkaline phosphatase. Depending on the duration of symptoms and severity of obstruction, coagulation can be altered in addition to renal dysfunction. Leukocytosis is more likely seen in infectious and inflammatory causes of obstruction such as cholangitis or cholecystitis.

# IMAGING STUDIES

- ***Ultrasound***
- ***Cholangiography***
  - MRCP
  - ERCP
  - PTC
- ***Contrast enhanced CT abdomen***
- ***Endoscopic ultrasound (EUS)***

## Ultrasound:

Ultrasound showing dilation of the common bile duct (marked by cursors).



- **Ultrasound:**

- shows the size of the bile ducts
- defines the level of the obstruction
- identifies the cause (in some cases)
- gives other information related to the disease (e.g. hepatic metastases, gallstones, hepatic parenchymal change).



- A common bile duct stone may cause intermittent jaundice and dilation of the bile duct due to a 'ball valve' effect. Fluctuating liver function tests may be observed; if they are resolving, a stone may have been passed or become disimpacted at the ampulla of Vater. The resultant pressure changes in the bile duct will be intermittent and not sufficient to cause intrahepatic dilation. Magnetic resonance cholangiopancreatography (MRCP) is indicated if a stone is not visible on ultrasound.

- In hepatic parenchymal disease (e.g. cirrhosis), fibrosis may prevent the intrahepatic bile ducts dilating, resulting in dilation confined to the extrahepatic bile ducts. The question then is whether the derangement of liver function is related to the liver disease or extrahepatic disease; MRCP may be helpful.

- The 'normal' common bile duct is often quoted as <7 mm in diameter. Mild dilation of the bile duct (<10 mm) may be insignificant if liver function tests are normal. Patients may be described as having a 'baggy' bile duct particularly post-cholecystectomy. The important factor is derangement of liver function. MRCP is usually required to exclude stones in the common bile duct



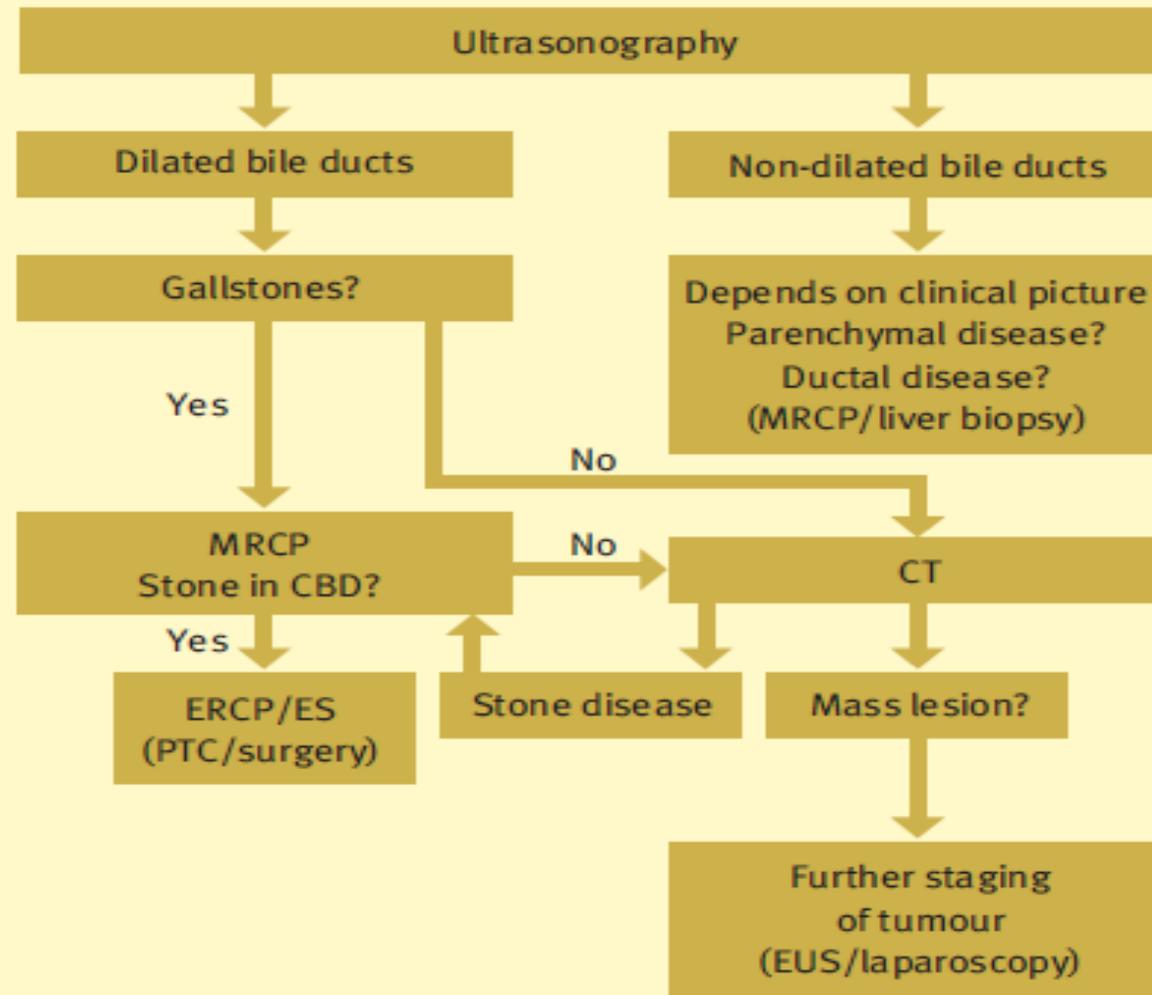
- ***Biliary dilation is absent*** – the cause of jaundice is assumed to be other than extrahepatic cholestasis. Metastatic hepatic disease is in this category, but the tumour required to cause clinical jaundice is extensive and other causes should be sought. The jaundiced patient with liver metastases may have biliary obstruction due to infiltration and obstruction of the bile ducts at or near the porta hepatis. The intrahepatic ducts are dilated but attention may be drawn to the metastases, missing the opportunity to palliate symptoms by relieving the obstruction. Other signs of liver disease may be apparent on ultrasound.

The echo-texture of the liver, splenomegaly, ascites, and signs of portal hypertension may be present, indicating chronic underlying liver disease as the possible cause.

Further imaging is unlikely to be helpful in the absence of biliary dilation or other abnormality on ultrasound, and investigation should focus on the medical causes of jaundice. Ultrasound assessment may be suboptimal in some cases (e.g. obesity) and further imaging with CT or MRCP is appropriate.

Biliary stenting to relieve obstruction and a biopsy for histological confirmation may be undertaken if metastatic disease is present. Liver biopsy is contraindicated if there is an obstruction of the bile duct due to the risk of a bile leak and subsequent biliary peritonitis. A biopsy of the primary lesion is therefore often taken during placement of a biliary stent.

## Assessment of jaundice



MRCP: Magnetic resonance cholangiopancreatography; ERCP: Endoscopic retrograde cholangiopancreatography; ES: Endoscopic sphincter papillotomy. PTC: Percutaneous transhepatic cholangiography; EUS: Endoscopic ultrasound; CBD: Common bile duct.

**Further imaging:** spiral CT and MRI has revolutionized the management of obstructive jaundice. After initial ultrasound, crosssectional imaging is used to gain further information for staging (see below) or if more specific assessment is required.

The choice depends on indications, local availability and expertise. Either can be used for tumour staging, but identifying non-calcified gallstones (the majority) on CT is difficult, so MRCP is preferred if stones in the common bile duct are suspected. MRCP gives exquisite assessment of the pancreatic duct and bile ducts without the risks inherent in endoscopic retrograde cholangiopancreatography (ERCP), rendering diagnostic ERCP virtually obsolete.

# Management of Obstructive Jaundice

- The first step in management of obstructive jaundice is based on the acuity of the disease and clinical status of the patient. Patients with hemodynamic instability, coagulopathy, and/or renal dysfunction need to be quickly resuscitated prior to managing the specific etiology of the obstruction. In the presence of cholangitis, often it is difficult to stabilize the patient until the obstruction is relieved and source control of the infection achieved.

- RESUSCITATION

- ***Presents with cholangitis***

Goal = resuscitation

- 1) Intravenous fluids to correct dehydration and pre-renal failure
- 2) Broad spectrum antibiotics - Gram negative coverage is essential
- 3) Correct coagulopathy, if present
- 4) Upon stabilization, decompress biliary obstruction without surgical intervention (ERCP or PTC as described above)
- 5) Further treatment of obstruction based on etiology

- ***Presents with jaundice in the absence of cholangitis***

Goal = diagnosis and management of obstruction

- 1) US and blood work to confirm biliary obstruction
- 2) Advanced imaging to identify site and etiology of obstruction if remains unclear

## **Bile duct stones**

Several options are available after investigations have revealed bile duct stones; selection depends on:

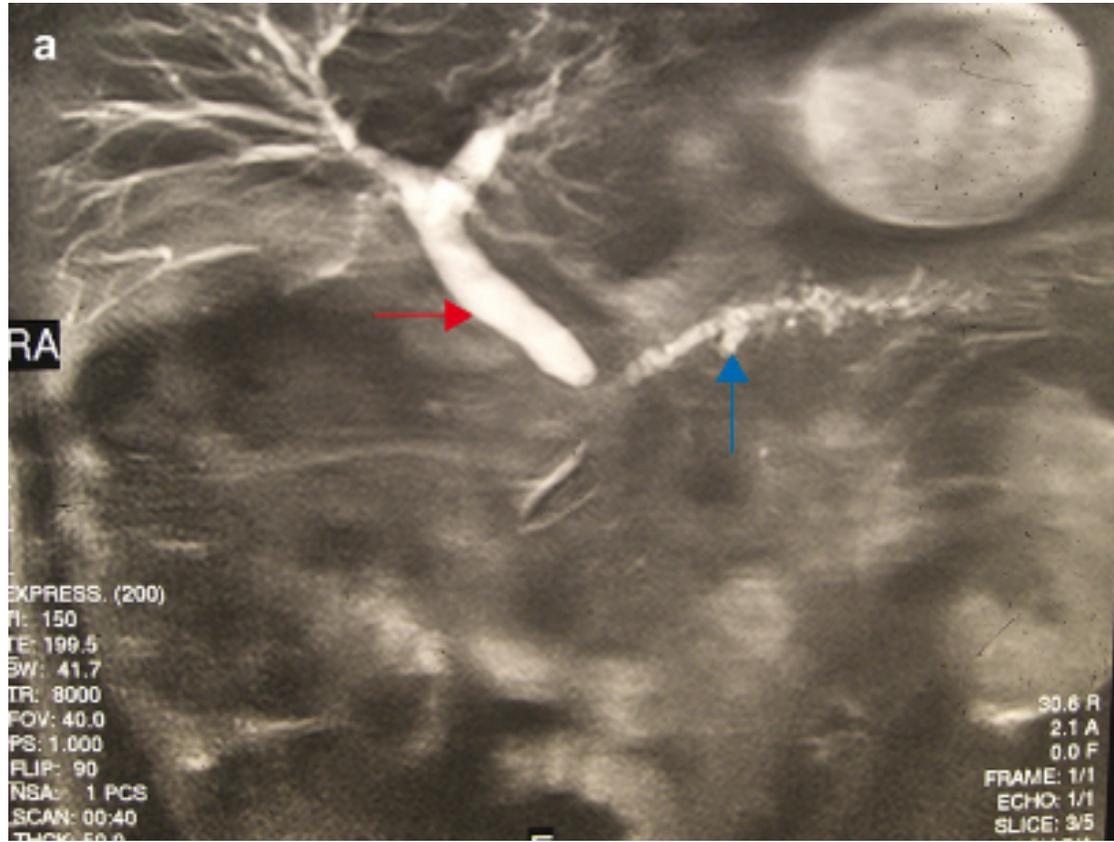
- physical condition
- comorbidity and medical history
- previous attempts at intervention
- if the patient has had a cholecystectomy
- availability of equipment/theatre/anaesthetist/expertise of interventionist
- patient preference.

- **ERCP±sphincterotomy:** ERCP has a success rate of about 90%
- and a low complication rate in experienced hands, but risks such
- as bleeding from damage to a branch of the superior pancreaticoduodenal
- artery (1–2%), perforation (1–2%), acute pancreatitis
- (2–5%; severe 0.1%) are inherent to the procedure. Technical
- problems such as failure to cannulate/identify the ampulla of Vater and anatomical anomalies (e.g. duodenal diverticulum) can cause difficulties.

ERCP may be considered the definitive treatment for some unfit patients, but most will proceed to cholecystectomy to remove remaining gallstones and prevent further complications.

**a** MRCP showing 'double duct dilation' with pancreatic cancer. The common bile duct is shown by the red arrow and the pancreatic duct is shown by the blue arrow.

**b** Same patient after percutaneous transhepatic cholangiography and insertion of Wall stent.



## Complications of stenting

### Immediate

- Sepsis
- Haemorrhage
- Acute pancreatitis
- Perforation and bile leak (peritonitis)

### Late

- Recurrent jaundice due to:
  - Displacement
  - Sludging
  - Overgrowth by neoplasm
- Erosion into adjacent viscus

**Thank you**