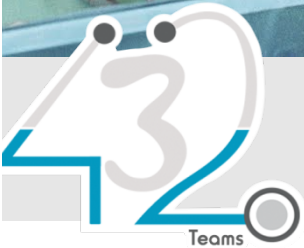




# 432 Surgery Team

## 18 Biliary Obstruction and Biliary Stones



**Done By:**  
Ghadah Alharbi  
Othman.T.Almutairi

**Reviewed By:**  
Othman.T.Almutairi

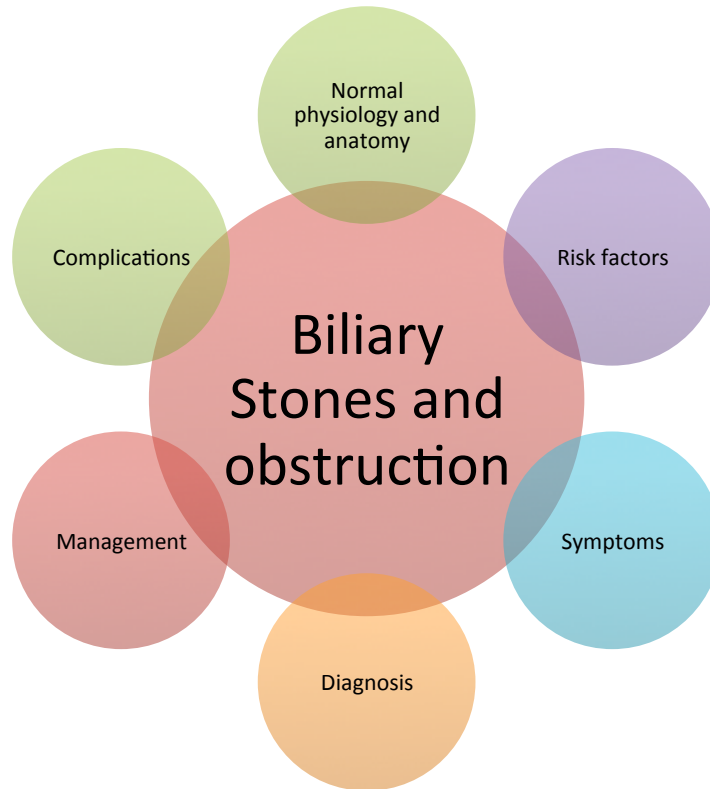
جامعة  
الملك سعود  
King Saud University



**COLOR GUIDE:** • **Males' Notes** • **Important** • **Additional**

# Objectives

Not given



# Normal physiology of the biliary system

## Anatomy of the biliary system <sup>(1)</sup>:

The biliary system consists of the organs and ducts (**bile ducts, gallbladder, and associated structures**) that are involved in the production and transportation of bile.

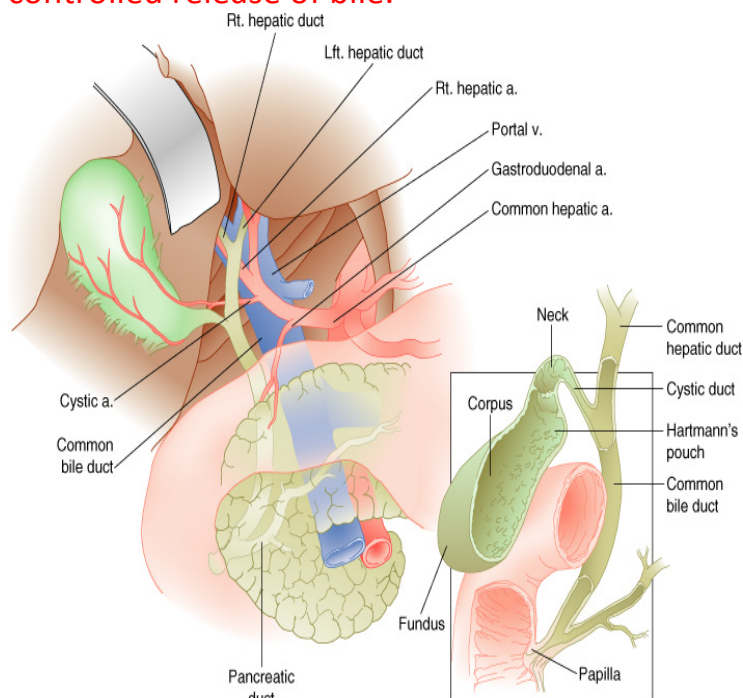
The transportation of bile follows this sequence:

- 1 When the liver cells secrete bile, it is collected by a system of ducts that flow from the liver through the right and left hepatic ducts.
- 2 These ducts ultimately drain into the common hepatic duct.
- 3 The common hepatic duct then joins with the cystic duct from the gallbladder to form the common bile duct, which runs from the liver to the duodenum (the first section of the small intestine).
- 4 However, not all bile runs directly into the duodenum. About 50 percent of the bile produced by the liver is first stored in the gallbladder, a pear-shaped organ located directly below the liver.

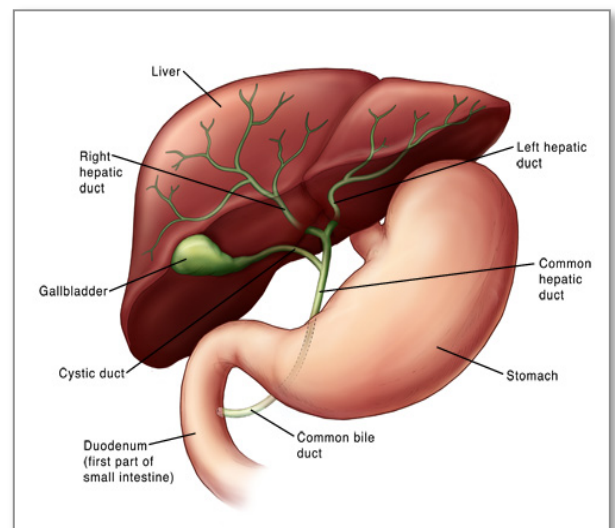
Then, when food is eaten, the gallbladder contracts and releases stored bile into the duodenum to help break down the fats.

The biliary system's main function includes the following:

To drain waste products from the liver into the duodenum, help in digestion with the controlled release of bile.



Copyright © 2004, Elsevier.



[http://www.nebraskamed.com/app\\_files/images/staywell/274302.jpg](http://www.nebraskamed.com/app_files/images/staywell/274302.jpg)



## Physiology of the biliary tract (2):

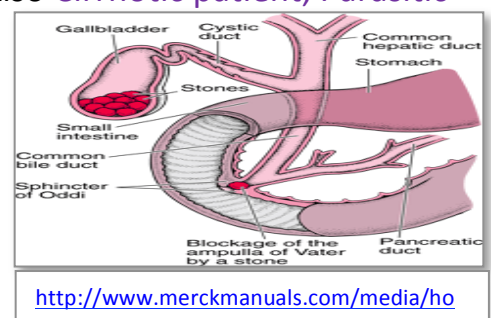
The biliary tract collects, stores, concentrates, and delivers bile secreted by the liver. Its motility is controlled by neurohormonal mechanisms with the vagus and splanchnic nerves and the hormone cholecystikinin playing key roles. These neurohormonal mechanisms integrate the motility of the gallbladder and **sphincter of Oddi (SO)** with the gastrointestinal tract in the fasting and digestive phases. During fasting most of the hepatic bile is diverted toward the gallbladder by the resistance of the SO. The gallbladder allows the gradual entry of bile relaxing by passive and active mechanisms. During the digestive phase the gallbladder contracts, and the SO relaxes allowing bile to be released into the duodenum for the digestion and absorption of fats.

## Pathophysiology of bile stones (3):

Spectrum ranges from asymptomatic, colic (temporary blockage), cholangitis (infection of the biliary tree), choledocholithiasis, cholecystitis (inflammation from obstruction of CBD or cystic duct).

Majority are asymptomatic **(80%)**. There are two main types of gallstones. About 80% are **cholesterol stones**, (containing more than 50% of crystalline cholesterol monohydrate). The remainder are **pigment stones** (composed predominantly of bilirubin calcium salts and are designated).

Cholesterol is rendered soluble in bile by aggregation with water-soluble bile salts and water-insoluble lecithins, both of which act as detergents. When cholesterol concentrations exceed the solubilizing capacity of bile (super-saturation) [lead to stasis], cholesterol can no longer remain dispersed and nucleates (accumulates) into solid cholesterol monohydrate crystals. Sludge is crystals without stone (first step in stone formation or independent of it). Cholestasis (impaired flow and motility) can predispose to stones. Pathogenesis of pigment stones is based on the presence in the biliary tract of unconjugated bilirubin (which is poorly soluble in water) and precipitation of calcium bilirubin salts. Thus, **infection** of the biliary tract, as with *Escherichia coli* or *Ascaris lumbricoides* or by the liver fluke *Opisthorchis sinensis*, increases the likelihood of pigment stone formation. Also **Cirrhotic patient, Parasitic infections**.



# Risk factors and symptoms of biliary stones

**Risk factors** <sup>(3)</sup>: **Five Fs: Female, Fair** “white women”, **Fat** “overweight”, **Forty** “age near or above 40”, and **Fertile** “premenopausal-increased estrogen is thought to increase cholesterol levels in bile and decrease gallbladder contractions”.

## Frequency:

US: affected by race, ethnicity, sex, medical conditions, and fertility. 20 million have GS. Every year 1-2% of people develop them. **Hispanics** are at increased risk. Internationally: 20% of women, 14% of men. Patients over 60 prevalence was 12.9% for men, 22.4% for women.

## Morbidity/Mortality:

Every year 1-3% of patients develop symptoms. Asymptomatic GS are not associated with fatalities. Morbidity and mortality **is associated only with symptomatic stones**.

## Race:

Highest in **fair skinned** people of northern **European** descent and in Hispanic populations. High in Pima Indians (75% of elderly). In addition, **Asians** with stones are more likely to have **pigmented stones** than other populations. African descent with Sickle Cell Anemia.

## Age:

It is **uncommon for children** to have gallstones. If they do, it's more likely that they have congenital anomalies, biliary anomalies, or hemolytic pigment stones. **Incidence of GS increases with age 1-3% per year**.

## Differential Diagnosis:

- ◆ Abdominal Aortic Aneurysm “AAA” – Appendicitis – Cholangitis-cholelithiasis-Diverticulitis-Gastroenteritis-hepatitis-Pancreatitis-renal colic-pneumonia-IBD- MI-SB.

## Symptoms:

**Typical:** Recurrent right upper quadrant pain “or upper epigastric”, colicky in nature, associated with nausea and vomiting, relieved by fasting, vomiting or pain-killers and aggravated by fatty food.

- ◆ Most patients develop symptoms before complications.
- ◆ Once symptoms occur, severe symptoms develop in 3-9%, with complications in 1-3% per year, and a cholecystectomy rate of 3-8% per year.

- ◆ Indigestion, bloating, **fatty food intolerance** occurs in similar frequencies in patients without gallstones, and is not cured with cholecystectomy.
- ◆ Best definition of colic is **pain that is severe in epigastrium or RUQ that last 1-5 hours often waking patient at night.**
- ◆ Once peritoneum irritated, localizes to RUQ.
- ◆ Small stones more symptomatic.

### **Physical Examination:**

- ◆ Vital signs and physical findings in asymptomatic cholelithiasis are completely normal.
- ◆ Fever, tachycardia, hypotension, alert you to more serious infections, including cholangitis, cholecystitis and Tachypnea.
- ◆ **Murphy's sign "Ask the patient to breath in (the gallbladder will move downward) while placing your hands around the patient's rib cage. In case of cholecystitis, the patient will have sudden pain when the gallbladder contacts your hands.**
- ◆ Impaction in the cystic duct or in the neck of the bladder will induce **a biliary pain** (Right hypochondrium + epigastrium).
- ◆ **Jaundice and pain** are found in CBD Obstruction or even signs of pancreatitis if it involves the pancreatic duct.

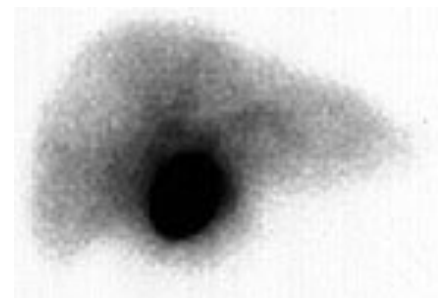
# Diagnosis and Management of biliary stones

- ◆ Labs with asymptomatic cholelithiasis and biliary colic should all be normal
- ◆ Elevated WBC is expected but not reliable.
- ◆ ALT, AST, AP more suggestive of CBD stones
- ◆ Amylase elevation may be GS pancreatitis

## Imaging studies:

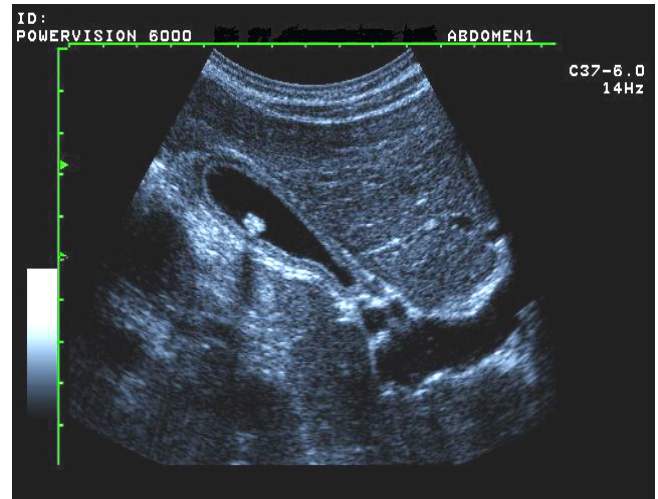
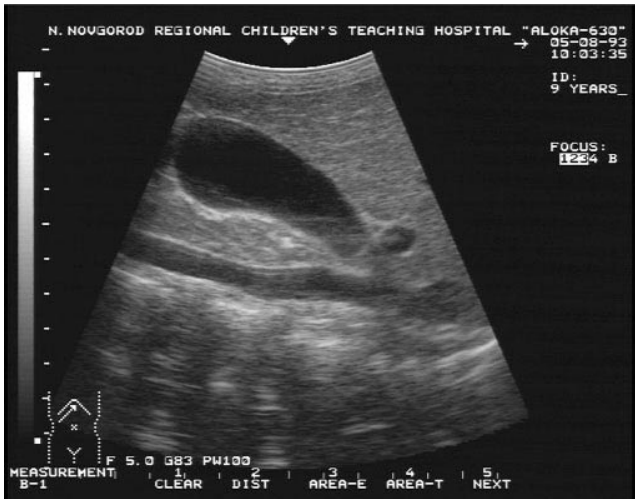
- ◆ US and Hida best. Plain x-rays, CT scans ERCP are adjuncts.
- ◆ X-rays: 15% stones are radiopaque, porcelain GB may be seen. Air in biliary tree, emphysematous GB wall.
- ◆ CT: for complications, ductal dilatation, surrounding organs. Misses 20% of GS. Get if diagnosis uncertain.
- ◆ Hida Scan:(Hepatobiliary Imino-Diacetic Acid scan)

Hida scan documents cystic duct patency, 94% sensitive, 85% specific, GB should be visualized in 30 min. If GB visualized later it may point to chronic cholecystitis. CBD obstruction appears as non-visualization of small intestine and False positives (high bilirubin).



## Diagnosis <sup>(4)</sup>:

1. **Ultrasound:** this non-invasive technique gives three pieces of information: the presence of gallstones “acoustic shadow”, the thickened wall of the gallbladder in acute or chronic inflammation, the diameter of the common bile duct, which if over 7 mm, is suggestive of the presence of stones within. But it is unreliable in detecting stones in the bile ducts “like the CT”, especially at the lower end where they are obscured by the overlying duodenal gas.



2. **Upper gastrointestinal endoscopy**: to exclude an associated peptic ulcer or hiatus hernia.
3. **Liver function tests**: indicated in jaundice, present or past, is a feature. Persistently raised alkaline phosphatase is suspicious of choledocholithiasis.
4. **Magnetic resonance cholangiopancreatography "MRCP"**: permits visualization of the biliary tree. This non-invasive producer provides the same diagnostic information as ERCP but without its associated risks "perforation, bleeding, and **pancreatitis**".
5. **Endoscopic retrograde cholangiopancreatography "ERCP"**: endoscopic intubation of the bile ducts through the ampulla of Vater is more invasive than MRCP, has been largely replaced by MRCP for diagnosis **but remains an essential part of hepatobiliary management in offering endoscopic therapeutic options and removing the reliance in open surgical producers.**



### **Emergency Department Care:**

- ◆ Suspect GB colic in patients with RUQ pain of less than 4-6h duration radiating to back.
- ◆ Consider acute cholecystitis in those with longer duration of pain, with or without fever. Elderly and diabetics do not tolerate delay in diagnosis and can proceed to sepsis.
- ◆ After assessment of ABCs, perform standard IV, pulse oximetry, EKG, and monitoring.
- ◆ Primary goal of ED care is diagnosis of acute cholecystitis with labs, US, and or Hida. Once diagnosed, hospitalization usually necessary. Some treated as OP.
- ◆ In patients who are unstable or in severe pain, consider a bedside US to exclude AAA and to assist in diagnosis of acute cholecystitis.

### **Medication:**

- ◆ Anticholinergics such as Bentyl (dicyclomine hydrochloride) to decrease GB and biliary tree tone. (20mg IM q4-6).
- ◆ Demerol 25-75mg IV/IM q3
- ◆ Antiemetics (phenergan, compazine).
- ◆ Antibiotics (Zosyn 3.375g IV q6) need to cover Ecoli(39%), Klebsiella(54%), Enterobacter(34%), enterococci, group D strep.

### **Further Inpatient Care:**

- ◆ Cholecystectomy can be performed after the first 24-48h or after the inflammation has subsided. Unstable patients may need more urgent interventions with ERCP, percutaneous drainage, or cholecystectomy.

### **Prognosis:**

- ◆ Uncomplicated cholecystitis as a low mortality.
- ◆ Perforation of GB occurs in 3-15% with up to 60% mortality.
- ◆ Gangrenous GB 25% mortality.

**Management** <sup>(5)</sup>: **Laparoscopic cholecystectomy “LC”** is the appropriate treatment of the vast majority of patients with symptomatic gallstones.

## Complications of biliary stones

### 1. Cholecystitis

Persistence of stone impaction leads to inflammation of the gallbladder. Intravenous fluid resuscitation, and parenteral antibiotics (e.g., Piperacillin/Tazobactam) manage these patients. For mild to moderate acute Cholecystitis, LC is recommended. In sever cases **percutaneous cholecystectomy** can be performed. Drainage of the gallbladder in this manner almost always allows the episode of acute Cholecystitis to resolve. <sup>(5)</sup>

### 2. Choledocholithiasis

Generally is due to gallstones that originate in the gallbladder and pass through the cystic duct into the common bile duct. The most common manifestation of uncomplicated choledocholithiasis is **jaundice**. The diagnosis may be confirmed by **ERCP** or **percutaneous transhepatic cholangiography “PTC”**. <sup>(5)</sup>

### 3. Cholangitis

It is an infection of the common bile duct, which occurs in the presence of an obstruction to the normal biliary drainage, usually as a complication of stones in the duct. <sup>(4)</sup> The symptoms: **fever, jaundice and upper quadrant pain**. The inflammation will accumulate the pus in the biliary system, so drainage is required by **PTC**.

#### **Note(s):**

- We should switch to the open surgery whenever the anatomy was not clear or if there was bleeding.
- Estimated blood loss in the elective surgery = 5 cc.
- **Cholecystitis: inflammation of the gallbladder.**
- **Cholangitis: inflammation of the common bile duct.**
- **Cholelithiasis: stones in the gallbladder.**
- **Choledocholithiasis: stones in the common bile duct.**
- In case of inflammation, antibiotics before the surgery should treat the patient. **If there is gangrene or no response, the surgery should be done immediately.**
- Normally the biliary duct won't be seen in radiology unless it was dilated.

## 4. Obstructive jaundice

**Additional information:** Accumulation of bilirubin in the bloodstream and subsequent deposition in the skin causes jaundice (icterus). **Conjunctival icterus** is generally a more sensitive sign of hyperbilirubinemia than generalized jaundice. Total serum bilirubin values are normally 0.2-1.2 mg/dL. Jaundice may not be clinically recognizable until levels are at least 3 mg/dL. Urine bilirubin is normally absent. When it is present, only conjugated bilirubin is passed into the urine. This may be evidenced by **dark-colored urine** seen in patients with obstructive jaundice or jaundice due to hepatocellular injury. The lack of bilirubin in the intestinal tract is responsible for the **pale stools** typically associated with biliary obstruction. <sup>(6)</sup>

Serum bilirubin values (**especially direct**) are usually elevated. **Alkaline phosphatase (ALP)** is markedly elevated in persons with biliary obstruction. However, high levels of this enzyme are not specific to cholestasis. To determine whether the enzyme is likely to be of hepatic origin, measure **gamma-glutamyl transpeptidase (GGT)**. <sup>(6)</sup>

### **Note(s):**

- Ampulla of Vater receives the openings of the bile and pancreatic ducts, so in case of obstruction, the patient will get pancreatitis.
- One of the complications of ERCP is pancreatitis.
- **General management:** do PTC to drain the pus caused by cholangitis, then ERCP to remove the stones, and finally cholecystectomy.
- **Dilatation of the biliary system = Obstructive jaundice.**

**Treatment of obstructive jaundice:** **ERCP** to remove the stone, then we do cholecystectomy in the same admission.

## **SUMMARY (Principal and practice, Davidson)**

### **Gallstones**

1. Most gallstones form because of failure to keep cholesterol in solution. This can result in pure cholesterol stones, but more commonly the stones also acquire a content of bile pigment as they enlarge, forming mixed stones.
2. Pigment stones are the most common type of stone in some far eastern countries but are less common in western society, where they are associated with chronic haemolysis, biliary stasis and cirrhosis.
3. Only 15% of stones contain enough calcium to be seen on a plain film.
4. The majority of individuals with gallstones are asymptomatic and remain so, the presence of gallstone is not in itself an indication of cholecystectomy.
5. Gallbladder stones may cause flatulent dyspepsia, biliary colic, acute cholecystitis and gallbladder cancer (rare incidence does not affect the decision of resection in asymptomatic pt).
6. Gallstones that migrate into the bile duct can cause obstructive jaundice, cholangitis and acute pancreatitis although they often remain asymptomatic.
7. Gallstone ileus is a rare form of intestinal obstruction; stones large enough to obstruct the gut are usually too large to pass through the ampulla of Vater and have gained access to the gut by an internal fistula involving the gallbladder.

### **Acute cholecystitis**

1. In the great majority of cases acute cholecystitis is associated with gallstones and results from obstruction of gallbladder flow.
2. In contrast to biliary colic, which results from obstruction alone, acute cholecystitis is associated with infection and a systemic illness.
3. The patient appears unwell, has pyrexia and tachycardia and is tender in the right hypochondrium; Murphy's Sign is almost always positive.
4. In 90% of cases, acute cholecystitis will settle with conservative treatment (nil by mouth, IV fluids, antibiotic, nasogastric suctioning if appropriate).
5. In 10% of cases, disease progression leads to life-threatening complication: empyema, gangrene and perforation.
6. Given the gallbladder is permanently diseased and that complication may supervene, most surgeons now advocate early cholecystectomy (within 5 days) for acute cholecystitis. '

#### **Surgical treatment of gallstones**

1. Asymptomatic: doesn't require unless there's a high risk of gallbladder cancer.
2. Symptomatic: Elective cholecystectomy is indicated.
3. Laproscopic cholecystectomy is associated with less pain, shorter hospital stay and faster return to normal activity with less abdominal scarring.

## **IMPORTANT NOTES FROM EXTERNAL RESOURCES**

### Notes

Principal and practice by Davidson

(1) <http://www.urmc.rochester.edu/encyclopedia/content.aspx?ContentTypeID=85&ContentID=P00659>

(2) <http://www.hindawi.com/journals/isrn/2013/837630/>

(3) [http://ksumsc.com/download\\_center/Archive/2nd/432/02%20GIT%20%20BLOCK/432%20Teams%20Work%20Cholecystitis.pdf](http://ksumsc.com/download_center/Archive/2nd/432/02%20GIT%20%20BLOCK/432%20Teams%20Work%20Cholecystitis.pdf)

(4) General Surgery Lecture Notes by Harold Ellis 12<sup>th</sup> edition, the gallbladder and bile ducts, page 266.

(5) The Washington Manual of Surgery 6<sup>th</sup> edition, Biliary Surgery, page 363.

(6) <http://emedicine.medscape.com/article/187001-overview#a0104>



## Questions

- 1) Which one of the following is a common cause of acute pancreatitis?
  - a. Alcohol.
  - b. Autoimmune diseases.
  - c. Gall stones
  - d. Hyperlipidemia.
  
- 2) Which one of the following ultrasonic findings are signs of Acute cholecystitis. EXCEPT ?
  - a. Gallbladder wall thickness more than 6 mm
  - b. Pericholecystic fluid.
  - c. Sonographic Murphy sign.
  - d. absence of gallstones
  
- 3) Endoscopic stone extraction is indicated in one of the following.
  - a. CBD stones with patient post prior gastrectomy.
  - b. Intrahepatic stones'
  - c. Multiple CBD stones.
  - d. Multiple gallstones.
  
- 4) A 45 yo obese woman with cholelithiasis presents to the emergency room complaining of nausea and vomiting for 2 days, along with severe continuous mid abdominal pain. She has a low grade fever and the ER physician finds that she has a slightly elevated WBC's count (12,000, N=10,000-4,000) and an elevated Amylase 2000 mmol/l (N=23-125) the most likely diagnosis is:
  - a. Acute appendicitis
  - b. Acute Pancreatitis
  - c. Hepatitis
  - d. PUD



### Answers:

- First Questions: c  
Second Questions: d  
Third Questions: c  
Fourth Questions: b