

# **ACUTE CHOLECYSTITIS**

*Guidelines for students and interns.*

# **ГОСТРИЙ ХОЛЕЦИСТИТ**

*Методичний посібник для студентів та інтернів.*

МІНІСТЕРСТВО ОХОРОНИ ЗДОРОВ'Я УКРАЇНИ  
Харківський національний медичний університет.

**Abdominal surgery**

**Topic N 2. *Acute cholecystitis***

## **ACUTE CHOLECYSTITIS**

*Абдомінальна хірургія*

*Тема №2 Гострий холецистит*

## **ГОСТРИЙ ХОЛЕЦИСТИТ**

*Методичний посібник для студентів та інтернів.*

*Затверджено*

*Вченою радою ХНМУ*

*Протокол № 5 від 17.05.2018*

*Харків,*

*ХНМУ*

*2018*

Abdominal Surgery. Contents module 1. Topic №2 Acute cholecystitis, diagnostics and treatment/ Document comp.: Igor Kryvoruchko, Alexander Tonkoglas,. Vladimir Cheverda, Samkha-Kateryna Goni - Kharkiv. KhNMU.2018- 14p.

Document compilers: Igor Kryvoruchko  
Alexander Tonkoglas  
Vladimir Cheverda  
Samkha-Kateryna Goni

Абдомінальна хірургія, змістовний модуль 1. Тема №2 Гострий холецистит.

Методичний посібник для студентів та інтернів/уп. І.А. Криворучко,,  
О.А. Тонкоглас, В.М. Чеверда, С.-К.Т. Гоні.-Харків: ХНМУ 2018- 14с

Упорядники: І. А. Криворучко  
О.А. Тонкоглас  
В.М. Чеверда,  
С.-К.Т. Гоні

# ACUTE CHOLECYSTITIS

Cholecystitis is an inflammation of the gallbladder that causes severe [abdominal pain](#). In 90-95% of cases, acute cholecystitis is caused by [gallstones](#) in the gallbladder. Severe illness and, rarely, tumors of the gallbladder may also cause cholecystitis.

## ANATOMY

The esophagus, stomach, large and small intestine, aided by the liver, gallbladder and pancreas convert the nutritive components of food into energy and break down the non-nutritive components into waste to be excreted.

The gallbladder stores and concentrates bile, and the ducts function as a bile drainage system. The flow of bile through the bile ducts is affected by several factors, including hepatic secretory pressure, the tone in the sphincter of Oddi, the rate of gallbladder fluid absorption, and gallbladder contraction.

Anatomically, the gallbladder is a pear-shaped musculo membranous reservoir lying in the gallbladder fossa on the inferior aspect of the liver. The fundus of the gallbladder lies close to the anterior abdominal wall, near the hepatic flexure of the colon. The surface marking of the gallbladder fundus is in the region of the costal cartilage. At this point, it is covered by peritoneum; its appearance may be obscured, owing to its proximity to the hepatic flexure of the colon. The body of the gallbladder is adjacent to the duodenum, which indents and produces a frequent ultrasonographic artifact that mimics gallstones or a mass in the gallbladder.

The gallbladder is a thin-walled, pear-shaped organ covered by peritoneum and attached to the inferior surfaces of the right quadrate lobes of the liver. Normally, it is 7 to 10 cm. long and 3 to 5 cm. in diameter and has a capacity of 30 to 60 ml. Anatomically, it is divided into a *fundus* or *tip*, which protrudes from the anterior edge of the liver, a *corpus* or *body*, an *infundibulum* called *Hartmann's pouch*, and a narrow *neck* that leads into the cystic duct (Fig. 2.1). Topographically, the fundus of the gallbladder is located behind the ninth right costal cartilage at the junction of the costal margin with the right border of the rectus abdominis muscle. The cystic duct from the gallbladder is about 2 to 4 cm. long and contains prominent mucosal folds called spiral folds or valves of Heister. The cystic duct joins the right lateral aspect of the common hepatic duct to form the common bile duct. The triangle bounded by the common hepatic duct medially, the cystic duct inferiorly and the cystic artery is known as **Calot's triangle**. The fact that cystic artery, right hepatic artery & para-right hepatic duct run within the triangle makes an important area of dissection during cholecystectomy.

An inflamed gallbladder may perforate the colon or duodenum because of the close proximity of the gallbladder to these structures. The mucosa of the gallbladder neck is thrown into folds, giving an echogenic appearance that may also mimic gallstones. A small pouch, known as the Hartmann pouch, projects from the right side

of the gallbladder neck. In patients in whom the Hartmann pouch is visible, pathology, particularly dilatation, is often present. The gallbladder fundus is often folded over; in such cases, the gallbladder then assumes a double-barrel appearance.

The physiological function of gallbladder: storage and concentration of hepatic bile; secretion of water and electrolytes; emptying bile into the common bile duct.

### **Biliary tract**

1. Intra-hepatic bile duct.
2. Extra-hepatic bile duct.
3. Gallbladder.
4. Oddi sphincter.

#### *Intra-hepatic bile duct:*

1. Bile canaliculi.
2. Segmental bile duct.
3. Lobal bile duct.
4. Hepatic part of left and right hepatic duct.

#### *Extra-hepatic bile duct:*

1. Left and right hepatic duct.
2. The common hepatic duct (diameter: 0.4-0.6 cm length: 2-4cm).
3. Common bile duct (diameter: 0.6-0.8 cm length: 7-9cm).
4. Gallbladder.
5. Cystic duct.

The extrahepatic bile duct system originates from the liver as the right and left hepatic ducts, each of which is 1 to 2 cm. long and drains the respective lobe of the liver. The two ducts join to form the common hepatic duct, a 2- to 4-cm. long structure in the porta hepatis. The union of the common hepatic duct with the cystic duct gives rise to the common bile duct, which is 8 to 15 cm. long and 5 to 10mm. in outside diameter. The common bile duct descends in the hepatoduodenal ligament to the right of the hepatic artery and anterior to the portal vein, passes behind the first part of the duodenum and through the pancreas, and enters the descending duodenum on its posteromedial aspect about 10 cm. distal to the pylorus at the papilla of Vater. The choledochoduodenal junction is an oblique passageway through the duodenal wall occupied by the common bile duct and the main pancreatic duct of Wirsung. These two ducts usually join in a common channel, the ampulla of Vater, which opens into the duodenum at the papilla of Vater; however, the two ducts may join before entering the duodenal wall or may empty into the duodenum through separate openings. The muscle of the choledochoduodenal junction, called the sphincter of Oddi, regulates the flow of bile and consists of several components. The bile secretion is around 0,5-1000 ml per day.

The arterial blood supply to the common bile duct comes mainly from the retroduodenal artery, a branch of the gastroduodenal artery. The gallbladder is nourished by the cystic artery, which originates from the right hepatic artery, to

the right of and behind the common hepatic duct, and divides into anterior and posterior branches. During cholecystectomy, the cystic artery is usually found in the cystic triangle of Calot, a space bounded by the liver, the common hepatic duct, and the cystic duct. The triangle contains the right hepatic artery with its cystic artery branch, a large lymph node, and, in its depths, the right branch of the portal vein. Venous drainage from the extrahepatic biliary system is into the portal vein. Lymphatic vessels from the gallbladder join those from the liver to empty into the thoracic duct. Lymph nodes at the neck of the gallbladder, at the junction of the cystic duct and hepatic ducts, and at the end of the common duct play a prominent role in the lymphatic drainage and are regularly enlarged in cholecystitis. The innervation of the biliary system is similar to that of the liver. Vagal stimulation causes contraction of the gallbladder, whereas sympathetic stimulation produces the reverse actions. The effect of vagal stimulation on the sphincter of Oddi is variable.

## ETIOLOGY AND PATHOGENESIS

Appearance of acute cholecystitis is associated with the action of a few etiological factors.

Acute cholecystitis represents an acute inflammation of the gallbladder, caused in most instances by obstruction of the cystic duct, resulting in acute inflammation of the gallbladder wall; the usual cause of the obstruction is a gallstone. Acute cholecystitis is one of the major complications of cholelithiasis. The inflammatory process begins with a calculous obstruction of the cystic duct or gallbladder neck. The exact mechanism by which gallbladder inflammation is initiated is unknown.

**Pathology:** cystic duct obstruction → gallbladder → edema → suppurate → gangrene → pericholecystic abscess → perforation.

Infection and stagnation of the bile (bilious hypertension) play leading roles in its development. Microorganisms are identified in 80% of cases early in the course of disease; *Escherichia coli* is the primary organism found; other organisms include gram-negative aerobic rods, enterococci, and a number of anaerobes. The bacterial invasion is not considered to be a primary event, because in 20% of patients, no bacterial growth occurs in surgical specimens. The general consensus is that bacterial infection is a secondary event, not an initiating one. Supposedly, there are 3 ways that the infection gets into gallbladder, namely - hematogenic, lymphogenic and enterogenous. In most cases the infection of the gallbladder occurs hematogenically (from the systemic blood circulation along the system of common hepatic artery or from the gastrointestinal tract on the porta vena).

Spontaneous resolution of acute cholecystitis may occur within 5-7 days after onset of symptoms, because of the reestablishment of cystic duct patency. In the majority of such cases, fibrotic wall thickening of the gallbladder occurs; this is characteristic of chronic cholecystitis. In more than 90% of cholecystectomy specimens, the histologic pattern is one in which acute cholecystitis is superimposed on chronic cholecystitis. If cystic duct patency is not reestablished, inflammatory cell

infiltration of the gallbladder wall in association with mural and mucosal hemorrhagic necrosis follows. Gangrenous cholecystitis may be seen in as many as 21% of cases.

Acalculous cholecystitis occurs in a different clinical setting. It occurs more often in males (usually children) and in persons older than 65 years. The pathophysiology of acalculous cholecystitis is not well understood but is probably multifactorial. It is probable that acalculous cholecystitis occurs through the combined effects of the actions of systemic mediators of inflammation; localized or generalized tissue ischemia; and bile stasis.

Often, predisposing factors place persons at risk for bile stasis; such factors include starvation; use of parenteral nutrition; use of narcotic analgesics; and a lack of mobility in postoperative states. Hypovolemia and shock predispose patients to tissue ischemia. Ischemia, such as occurs in association with small-vessel vasculitis, may be a primary cause of acalculous AC; ischemia may also occur as a complication of hepatic chemoembolization. Often, functional cystic duct obstruction is present; such obstruction is related to inflammation and viscous bile. Extrinsic compression may play a role in the development of bile stasis.

In the majority of patients with acalculous acute cholecystitis, secondary infection with gram-negative enteric flora occurs; however, in patients with typhoid fever, infection with *Salmonella* organisms has been identified as a primary event. AIDS-related cholecystitis and cholangiopathy may occur secondary to cytomegalovirus (CMV) infection and infections with *Cryptosporidium* organisms.

In patients who have emphysematous cholecystitis, ischemia of the gallbladder wall is followed by infection with gas-forming organisms that produce gas in the gallbladder lumen, in the gallbladder wall, or both. In 30-50% of patients, preexisting diabetes mellitus is present; the male-to-female ratio is 5:1. Gas may be confined to the gallbladder; however, in 20% of cases, gas is also seen in the rest of biliary tree. Gallstones are not present in 30-50% of cases, and the mortality rate is 15%. There is a predisposition for gangrene formation and perforation, but clinical symptoms are mild; such symptoms can be deceptive. Emphysematous cholecystitis may occur after chemoembolization performed as palliation for hepatocellular carcinoma; after atheromatous embolism during aortography; and after gallbladder hypoperfusion during cardiorespiratory resuscitation.

## CLASSIFICATION

- **According to the etiology:** 1. Calculous. 2. Acalculous. 3. Parasitic diseases.
- **Clinical and morphological forms:** 1. Simple. 2. Phlegmonous. 3. Gangrenous. 4. Perforated.

**Complications of acute cholecystitis:** hydrops; empyema; paravesical infiltration; paravesical abscess; peritonitis (local and diffuse); biliodigestive fistulas; pancreatitis; cholangitis; jaundice; liver abscesses; sepsis.

Acute cholecystitis (AC) occurs as a result of inflammation of the gallbladder

wall, usually as a result of obstruction of the cystic duct. In 90-95% of cases, AC is initiated by the impaction of a calculus in the neck of the gallbladder or in the cystic duct. Acute acalculous cholecystitis (AAC) represents inflammation of the gallbladder in the absence of gallbladder calculi. AAC occurs more commonly in children and adults who are critically ill or in those who have recently undergone the stress of severe trauma, burns, or major surgery.

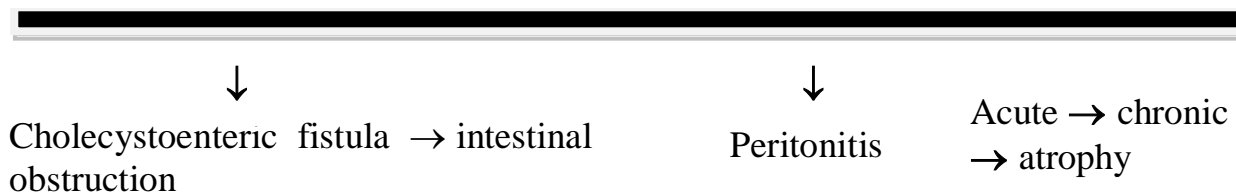
## ACUTE CALCULOUS CHOLECYSTITIS

### Clinical-morphological forms:

1. Simple (catarrhal).
2. Phlegmonous.
3. Gangrenous.
4. Perforated.

## PATHOLOGY

Cystic duct obstruction → gallbladder → edema → suppurate → gangrene →



## CLINICAL FEATURES

### 1. Complains:

Acute calculous cholecystitis is diagnosed on the basis of symptoms and signs of inflammation in patients with peritonitis localised in the right upper quadrant.

In nearly every patient, abdominal pain of sudden onset is the first symptom of acute cholecystitis. Initially, this may be interpreted by the patient or the physician as another episode of biliary colic and may delay admission to the hospital. Key points of distinction include: the absence of food-related onset and the nature of the pain. At first, the pain is dull localized in the right upper quadrant, and constant. As the inflammatory process continues, parietal peritoneum becomes involved, and the pain becomes more intense and localized in the right subcostal area.

Pain can irradiates to the right shoulder or scapula, lumbar region or right shoulder girdle, sometimes to the heart (**cholecysto-cardial syndrome**).

Nausea is frequent, as it is in biliary colic, but vomiting is more common. Severe vomiting suggests the presence of a common bile duct stone, acute pancreatitis, or a bowel obstruction. Loss of appetite, malaise are more common in patients with acute cholecystitis.

Suppurative complications of acute cholecystitis are manifested by fever



greater than 37 - 38° C, tachycardia, chills and jaundice.

## 2. Objective signs of disease:

- Dry and coated tongue.
- Abdominal wall in the right upper quadrant lags behind in the act of breathing.
- During superficial palpation - muscle tension and tenderness in the right upper quadrant.
- During deep palpation - strengthening of local pain, palpation of the gallbladder fundus is possible.
- Patient can feel pain during percussion in the right upper quadrant but auscultation – no changes.

## 3. Pathognomonic signs:

- **Mussy-Georgievsky's sign:** tenderness at the point of the phrenic nerve, between the heads of the sterno-cleidomastoid muscle.
- **Kera's sign:** pain during deep palpation in Ker's point.
- **Ortner's sign:** pain during tapping over the right costal arch by the edge of the hand.
- **Murphy's sign:** sharp pain in the right hypochondrium when the examiner hands press the gallbladder at the height of inspiration.
- **Blumberg's sign:** worsening of pain in the right upper quadrant when one's hand sharply off the abdominal wall after pressing it in the right upper region.

### 2.4.3. DIAGNOSIS

**Laboratory studies.** In the typical patient, there is a mild leukocytosis ranging from 10,000 to 15,000. White blood cell counts greater than 15,000 indicate the development of suppurative complications but are not reliable indicators of complicated cholecystitis.

Hyperbilirubinemia in the range more than 21μmol/l occurs in 20 to 30 per cent of patients, but jaundice is not usually clinically overt. Values exceeding this range suggest the presence of common bile duct stones or septic complications. It should be recognized that hyperbilirubinemia is not pathognomonic of choledocholithiasis and that all patients with acute cholecystitis and jaundice should not be subjected to common bile duct exploration.

Mild elevations of liver enzymes occur in 40 per cent of patients, and slight alkaline phosphatase elevations occur in 15 per cent. Abnormalities depend to a certain extent on the nature, severity, and duration of the disease but are not reliable indicators of complicated cholecystitis. Enzyme abnormalities usually resolve within 24 to 48 hours. In viral hepatitis, enzyme elevations are higher and persist for weeks. Liver enzyme elevation does not aid in the differentiation of alcoholic hepatitis and acute cholecystitis, and liver biopsy is sometimes necessary.

The serum amylase is abnormal in 15 per cent of patients with acute cholecystitis. Hyperamylasemia suggests the coexistence of choledocholithiasis and

perhaps pancreatitis. If acute pancreatitis is present, the amylase-creatinine clearance ratio will usually be greater than 5.

### **Radiologic studies.**

**X-ray.** The main value of plain x-ray examination of the abdomen in acute cholecystitis is to aid in the exclusion of other diseases. Occasionally, there may be an enlarged gallbladder shadow or evidence of gallstones (15% of gallstones are radiopaque).

Either of these findings is presumptive evidence of gallbladder disease in the patient with acute abdominal symptoms. If air is seen within the gallbladder or biliary tree, emphysematous cholecystitis or a cholecystenteric fistula should be suspected.

**Ultrasonography** has an accuracy of 96 per cent in detecting gallstones and should be performed routinely in the initial evaluation of a patient with suspected acute cholecystitis. The presence of calculi or an enlarged gallbladder substantiates the clinical diagnosis.

**CT scan.** CT scan may demonstrate evidence of acute cholecystitis, including gallbladder wall thickening, pericholecystic fluid and edema.

## **COMPLICATIONS OF ACUTE CHOLECYSTITIS**

➤ Paravesical infiltrate.

➤ Paravesical abscess.

➤ Empyema of gallbladder – Fig. 2.9.

➤ Perforated gallbladder. Occurs in 10% of acute cholecystitis, usually becomes a contained abscess in the right upper quadrant. Less commonly, perforates into adjacent viscus = cholecystoenteric fistula & the stone can cause gallstone ileus. Often perforates into the abdominal cavity with the progress of local unrestricted or general peritonitis

➤ Choledocholithiasis; obstructive jaundis; cholangitis; abscesses of the liver; acute pancreatitis; acute syndrome Mirizzi; sepsis and SIRS.

**Differential diagnosis with:** perforated peptic ulcer; acute pancreatitis; retrocaecal appendicitis; right lower lobe pneumonia; hepatic abscess; acute intestinal obstruction; renal colic.

## **TREATMENT OF ACUTE CHOLECYSTITIS**

### **Conservative treatment:**

1. Hospital admission.
2. Bed mode during 7 – 10 days.
3. Diet № 5a, warm drink; food intake 5-6 time a day by small portions.
4. Intravenous hydration (saline solutions, 5% glucose solution, etc.).
5. Systemic antibiotics (the antibiotic regimen should be appropriate for typical bowel flora - gram-negative and anaerobes).
6. Elimination of pain: M-cholinolitics (atropine sulfate, metacin, plathyphyllin).

Spasmolitics (papaverin, no-spa). Analgetics (analgin, baralgin). **Non-narcotic analgetics (!).**

7. Monitoring of the patient: temperature, physical examination, and laboratory values.

### **Surgical treatment:**

1. Attack within 48-72 h of diagnosis.
2. Deterioration in patient's general condition.
3. Complications are present.
4. Perforation.
5. Peritonitis.
6. Acute obstructive suppurative cholangitis.
7. Acute pancreatitis.

Early cholecystectomy prevents the development of complications or recurrent attacks during the recommended 6-week "cooling-off" period. In addition, early surgical treatment reduces operative morbidity without increasing mortality. If the diagnosis of acute cholecystitis is firmly established and the patient is an acceptable anesthetic risk, cholecystectomy should be performed within 48 hours of admission. Delayed operation is preferred only for those with coexistent medical problems that make surgical risk prohibitive, such as myocardial infarction, congestive heart failure, or pneumonia.

**Surgical methods:** open cholecystectomy; laparoscopic cholecystectomy.

**Open cholecystectomy:** midline laparotomy; bright subcostal incision; mini right subcostal incision. In this procedure, the gallbladder is removed through an abdominal incision (usually right subcostal) after the cystic duct and artery are ligated. The procedure is performed for acute and chronic cholecystitis. In some patients a drain may be placed close to the gallbladder bed and brought out through a puncture wound if there is a bile leak. The drain type is chosen based on the physician's preference. A small leak should close spontaneously in a few days with the drain preventing accumulation of bile.

The area is now isolated with packs. If the gallbladder is greatly distended, it is aspirated through the fundus by means of a trocar and cannula attached to a suction apparatus. The neck of the gallbladder is grasped. Then the very important dissection to display the junction of the cystic, the common hepatic and the common bile ducts is started. During the course of this dissection the cystic artery is found, and its relation to the common hepatic artery verified. Cholangiography is performed at this stage both to confirm that the anatomy of the biliary tree has been correctly identified and to check for stones in the main ducts. Only when anatomical and radiological tests are *both* satisfactory should any duct be divided. The cystic duct is ligated. Forceps are applied to the gallbladder side and the cystic duct is divided. From below and upwards, the gallbladder is dissected from its bed, dividing the peritoneum on the gallbladder. Only after the gallbladder has been removed and hemostasis assured, is the abdominal wall closed.

With severe inflammation in Calot's triangle (bounded above

by the liver, medial by the common hepatic duct and below by the cystic duct) it may be wise to open the gallbladder, extract all the stones and bile, and excise as much of the wall of the gallbladder as possible. The cystic duct opening is closed by a catgut suture from 'within'. Any mucous membrane remaining on the hepatic side may be diathermied. An alternative is cholecystostomy.

**Laparoscopic cholecystectomy.** In this procedure four puncture wounds are made in the abdomen, and the gallbladder dissected in the manner described previously. Eventually, the gallbladder is delivered through the umbilical puncture. This technique is applicable in 85 per cent of patients; its advantage is the rapid speed of recovery.

**Contraindication:**

- Carcinoma.
- Common bile duct stones and biliary stenosis.
- Severe abdominal infection.
- Operation history.
- Pregnancy.
- Cardiac and respiratory problems.
- Bleeding tendency.

**Conversion to open treatment.** Several studies demonstrated that the risk of conversion depends mainly on the degree of inflammation, pathology of gallbladder disease (e.g., thickness of gallbladder wall), age, male sex, and common bile duct diameter. Conversion rate in elective laparoscopic cholecystectomy may be 0% to 15%, but in cases of gangrenous cholecystitis or empyema it may be 50% to 83%. Ultrasound may help to predict the risk of conversion. However, the surgeon has to decide intra-operatively whether to convert to open procedure within a short time. It is necessary to stress that the conversion from laparoscopic cholecystectomy to an open procedure should never be considered as an "adverse outcome" or the surgeon's failure. The opposite is true - an early decision to convert in face of hostile anatomy, or the failure to progress, reflect solid judgement and understanding that the patient's safety is more important than the surgeon's ego. Clearly, reporting conversion rates without reporting the severity of gallbladder inflammatory disease means nothing.

## COMPLICATIONS OF CHOLECYSTECTOMY

- Bile leak ("biloma").
- Bile duct injury (about 5-7 out of 1000 operations. Open and laparoscopic surgeries have essentially equal rate of injuries, but the recent trend is towards fewer injuries with laparoscopy. It may be that the open cases often result because the gallbladder is too difficult or risky to remove with laparoscopy).
- Abscess.
- Wound infection.
- Bleeding (liver surface and cystic artery are most common sites).
- Hernia.

- Organ injury (intestine and liver are at highest risk, especially if the gallbladder has become adherent/scarred to other organs due to inflammation (e.g. transverse colon).
- Deep vein thrombosis/pulmonary embolism (unusual-risk can be decreased through use of sequential compression devices on legs during surgery).
- Fatty acid and fat-soluble vitamin malabsorption.

## CHOLECYSTOSTOMY

**Percutaneous cholecystostomy** has been used in the treatment and diagnosis of acute cholecystitis in patients who are poor risks for any surgical procedure or for general anesthesia. These may include patients with sepsis or severe cardiac, renal, pulmonary, or liver failure. Under local anesthesia, a fine needle is inserted through the abdominal wall and liver edge into the gallbladder under the guidance of ultrasound or computed tomography. Bile is aspirated to ensure adequate placement of the needle, and a catheter is inserted into the gallbladder to decompress the biliary tract.

**Open cholecystostomy** - is an alternative procedure and is preferred if cholecystectomy is technically hazardous or if the patient is a poor anesthetic risk. Patients too ill for cholecystectomy; are usually older than 65 years, with a compromised cardiovascular system or chronic lung disease. Cholecystostomy is readily performed under local anesthesia. Two stay sutures are inserted on either side of the fundus to steady the organ, the fluid contents of which are aspirated. The fundus is opened and stones are removed from the interior by Desjardins' forceps, aided, always, by a finger milking up a stone or stones from Hartmann's pouch. Minute calculi are often dislodged by strips of dry gauze passed into the interior. A large Foley catheter is placed in the gallbladder and the balloon inflated. The opening in the gallbladder is closed about the tube. The tube is brought through a portion of greater omentum, which is anchored to the gallbladder by the original stay sutures. The catheter is then brought to the surface through a separate stab incision. The abdominal incision is closed, and the catheter connected to a sterile bag.

## ACUTE ACALCULOUS CHOLECYSTITIS

Acute acalculous cholecystitis (AAC) may develop without gallstones in critically ill or injured patients, and appears to be increasing in incidence. In addition to injured or postoperative patients, patients with diabetes, malignant tumors, vasculitis, congestive heart failure, and shock or cardiac arrest may develop AAC. Ischemia/reperfusion injury is a central pathogenic feature, but bile stasis, opioid therapy, positive-pressure ventilation, and total parenteral nutrition have all been implicated as co-factors.

The following factors have been associated with acalculous cholecystitis:

- Surgery, particularly abdominal.
- Severe burns.
- Gastroenteritis.

- Severe trauma.
- Total parenteral nutrition.
- Mechanical ventilation.
- Blood transfusion reactions.
- Dehydration.
- Narcotic analgesia.
- Diabetes mellitus.
- Antibiotics, particularly broad spectrum.
- Hepatic arterial embolization (islet cell tumors and hepatocellular carcinoma).
- Postpartum complications.
- Vascular insufficiency and vasculitis, such as systemic lupus erythematosus and Sjögren syndrome.
- Arteriosclerosis/hypertension.
- AIDS, CMV, Cryptosporidium infections.
- Typhoid.

Acute acalculous cholecystitis is especially dangerous during a serious illness or following major surgery. The incidence of AAC appears to be increasing; it is likely that increased awareness and improved imaging studies are identifying more cases. The mortality rate remains about 30% because the diagnosis remains challenging, the affected patients are critically ill, and because the disease itself can progress rapidly due to a high incidence of gangrene (> 50%) and perforation (> 10%).

## **PATHOGENESIS**

**Gallbladder ischemia/reperfusion injury.** Gallbladder ischemia/reperfusion injury is a critical factor in the pathogenesis of AAC. Bacterial invasion of ischemic tissue is believed to be a secondary phenomenon; an increasing duration of ischemia increases mucosal phospholipase A<sub>2</sub> and superoxide dismutase activities, and increases mucosal lipid peroxide content. Longer periods of reperfusion produce further increases in mediator activity. The humoral response to gram-negative bacteremia or splanchnic ischemia and mediator release may be of primary importance. Lipopolysaccharide induces a marked host response, including the activation of the coagulation cascades and generation of platelet-activating factor, both of which have been implicated in animal studies of pathogenesis. Numerous observations of clinical low-flow states support this hypothesis, as does the pathologic observation of high rates of gallbladder necrosis and perforation. Gallbladder specimen arteriography reveals marked differences between acute calculous and AAC in humans. Whereas gallstone-related disease is associated with arterial dilatation and extensive venous filling, AAC is associated with multiple arterial occlusions and minimal to-absent venous filling.

*Bile Stasis.* Volume depletion may lead to concentration and stasis of bile, which can inspissate in the absence of gallbladder emptying. Opioid analgesics induce increased biliary pressure due to spasm of the sphincter of Oddi. Bile stasis may also be induced by positive-pressure mechanical ventilation with positive end-



expiratory pressure (PEEP). Bile stasis increases the concentration of lysophosphatidyl choline in bile, which promotes local injury of the gallbladder mucosa by disrupting normal water transport across gallbladder mucosa. Other compounds present in bile, such as beta-glucuronidase, have also been implicated in the pathogenesis of AAC. Long-term therapy with TPN causes bile stasis, and may be associated with an incidence of AAC of up to 30%. Serial gallbladder ultrasound studies in patients on long-term TPN show that the incidence of gallbladder “sludge”, only 6% during the first week of TPN, increases to 50% at 4 weeks and 100% at 6 weeks. Unfortunately, periodic stimulation of gallbladder contraction with cholecystikinin does not prevent AAC in critically ill patients, nor does enteral hyperlimentation, which preserves gallbladder motility.

## DIAGNOSIS

Most patients with AAC are critically ill, which makes the diagnosis challenging to make. Cholecystitis is but one of many potential causes of systemic inflammatory response syndrome or sepsis that may develop in such patients. Moreover, the differential diagnosis of jaundice in the critically ill patient is complex, and includes intrahepatic cholestasis from sepsis or drug toxicity and “fatty liver” induced by TPN, in addition to AAC. Rapid and accurate diagnosis is essential, as ischemia can progress rapidly to gangrene and perforation. Acalculous cholecystitis is sufficiently common that the diagnosis should be considered in every critically ill or injured patient with a clinical picture of sepsis and no other obvious source. Physical examination and laboratory studies are too non-specific to be reliable.

## CLINICAL FEATURES

Acute cholecystitis is diagnosed on the basis of symptoms and signs of inflammation in patients with peritonitis localised to the right upper quadrant.

Acute inflammation of the gallbladder causes pain, tenderness, and rigidity of the upper right abdomen that may radiate to the midsternal area or right shoulder and is associated with nausea, vomiting, and the usual signs of an acute inflammation. An empyema of the gallbladder develops if the gallbladder becomes filled with purulent fluid.

**Laboratory studies.** In the typical patient, there is a mild leukocytosis ranging from 10,000 to 15,000. White blood cell counts greater than 15,000 indicate the development of suppurative complications but are not reliable indicators of complicated cholecystitis.

### **Radiologic studies.**

**X-ray.** The main value of plain x-ray examination of the abdomen in acute cholecystitis is to aid in the exclusion of other diseases.

### **Emphysematous cholecystitis:**

1. 4/5 patients are men.

2. 1/3 patients are diabetic.
3. Due to infection or ischemia.
4. Cystic duct may be opened.
5. Gas in lumen/wall/bile ducts.
6. Complications: gangrene and perforation.

**Ultrasound.** Ultrasound of the gallbladder is the most accurate modality to diagnose AAC in the critically ill patient. Thickening of the gallbladder wall is the most reliable criterion. False-positives may occur when conditions including sludge, nonshadowing stones, cholesterosis, hypoalbuminemia, or ascites mimic a thickened wall. Other helpful ultrasonographic findings for AAC include pericholecystic fluid, or the presence of intramural gas or a sonolucent intramural layer or “halo” that represents intramural edema.

**Ultrasonography:** thickened gallbladder wall or edema; pericholecystic fluid; sonographic Murphy’s sign.

**Computed tomography.** Computed tomography (CT) is as accurate as ultrasound in the diagnosis of AAC. Appropriate criteria for diagnosis of AAC by CT are similar to the criteria described for ultrasound. Only a single retrospective study has compared all three modalities (ultrasonography, hepatobiliary scanning, and CT); ultrasonography and CT were comparably accurate and superior to hepatobiliary imaging. Comparable accuracy, low cost and bedside availability make ultrasonography the diagnostic modality of choice for AAC. Preference may be given to CT if other abdominal pathology is considered more likely.

**Laparoscopy.** Laparoscopy has been reported to be successful for both the diagnosis and therapy of AAC, although reports are limited to small series and there has been no randomized trial. Laparoscopy can be performed under local anesthesia and intravenous sedation at the bedside, and may be advisable to attempt if open surgical drainage is otherwise contemplated. Laparoscopy is possible in patients who have undergone recent abdominal surgery if “gasless” techniques are used. Diagnostic accuracy is high, and both laparoscopic cholecystostomy and cholecystectomy have been performed.

## TREATMENT

### **Conservative treatment:**

- Intravenous fluid and electrolyte replacement.
- Nasogastric suction.
- Systemic antibiotics.
- Parenteral analgesia.

**Surgical methods:** open cholecystectomy or laparoscopic cholecystectomy.

## MORTALITY/MORBIDITY

Mortality associated with acute cholecystitis is 5-10%; death mostly occurs in patients older than 60 years.



Acute cholecystitis may be complicated by empyema, gangrenous cholecystitis, gallbladder perforation, pericholecystic abscess, and bilioenteric fistula. Gangrenous cholecystitis is a frequent cause of gallbladder perforation. Suppurative complications are more frequent in the elderly. Most localized perforations may be satisfactorily treated by means of surgery.

Although free intraperitoneal perforation is rare, it is associated with a mortality of 25%. Necrosis of the gallbladder wall occurs in about 60% of cases of acalculous cholecystitis because gangrene and perforation are frequent occurrences. Mortality ranges from 9-66%.

The higher mortality in acute acalculous cholecystitis has been attributed to delayed diagnosis and comorbidities. The morbidity associated with emphysematous cholecystitis is higher, because of GB wall gangrene and perforation.

Recurrent symptoms are common in patients with acute cholecystitis who are treated expectantly; most patients need elective cholecystectomy.

## REFERENCES

1. Barie P S, Fischer E, Eachempati S R. Acute acalculous cholecystitis. *Curr Opin Crit Care*. (1999); 5: 144–150.
2. Johanning J M, Bruenberg J C. The changing face of cholecystectomy. *Am Surg*. (1988); 56: 643–647.
3. Kalliafas S, Ziegler D W, Flancbaum L, Choban S. Acute acalculous cholecystitis: Incidence, risk factors, diagnosis, and outcome. *Am Surg*. (1998); 64: 471–475.
4. Barie PS (1993) Acalculous and postoperative cholecystitis. In: Barie PS, Shires GT (eds) *Surgical intensive care*. Little, Brown, Boston, pp 837–857 .
5. Flancbaum L, Majerus T C, Cox E P. Acute post-traumatic acalculous cholecystitis. *Am J Surg*. (1985); 150: 252–256.
6. Taoka H. Experimental study on the pathogenesis of acute acalculous cholecystitis, with special reference to the roles of microcirculatory disturbances, free radicals and membrane-bound phospholipase A2. *Gastroenterol Jpn*. (1991); 26: 633–644.
7. Kaminski D L, Feinstein W K, Deshpande Y G. The production of experimental chole-cystitis by endotoxin. *Prostaglandins*. (1994); 47: 233–245.
8. Kaminski D L, Andrus C H, German D. et al. The role of prostanoids in the production of acute acalculous cholecystitis by platelet-activating factor. *Am Surg*. (1990); 212: 455–461.
9. Hakala T, Nuutila P J, Ruokonen E T, Alhava E. Microangiography in acute acalculous cholecystitis. *Br J Surg*. (1997); 84: 1249–1252.
10. Fabian T C, Hickerson W L, Mangiante E C. Post-traumatic and postoperative acute cholecystitis. *Am Surg*. (1986); 52: 188–192.
11. Deitch E A, Engel J M. Acute acalculous cholecystitis. Ultrasonic diagnosis. *Am J Surg*. (1981); 142: 290–292.
12. Mirvis S E, Whitley N N, Miller J W. CT diagnosis of acalculous cholecystitis. *J Comput Assist Tomog*. (1987); 11: 83–87.
13. Mirvis S E, Vainright J R, Nelson A W. et al. The diagnosis of acute acalculous cholecystitis: A comparison of sonography, scintigraphy, and CT. *AJR*. (1986); 147: 1171–1175.
14. Almeida J, Sleeman D, Sosa J L. et al. Acalculous cholecystitis: The use of diagnostic laparoscopy. *J Laparoendosc Surg*. (1995); 5: 227–231.
15. Lee M J, Saini S, Brink J A. et al. Treatment of critically ill patients with sepsis of unknown cause: Value of percutaneous cholecystostomy. *AJR*. (1991); 156: 1163–1166.
16. van Sonnenberg E, D'Agostino H B, Goodacre B W. et al. Percutaneous gallbladder puncture and cholecystostomy: Results, complications, and caveats for safety. *Radiology*. (1992); 183: 167–170.

*Навчальне видання*

***Змістовний модуль 1. Хірургічна гастроентерологія  
Тема №2 Гострий холецистит***

**Гострий холецистит.**

*Методичний посібник для студентів та інтернів.*

Упорядники: Криворучко Ігор Андрійович  
Тонкоглас Олександр Аркадійович  
Чеверда Віктор Михайлович  
Гоні Самха-Катерина Тахірівна

Відповідальний за випуск Тонкоглас О.А.