Complications of Cholecystectomy

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Morbidity and Mortality
Kings County Hospital Center
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Pt is a 43 year old male

CC: RUQ/epigastric abdominal pain and N/V x 1 day

HPI: similar pain x1 week, post-prandial, intermittent, lasted several hrs, resolved spontaneously

PMH: obesity, depression

PSH: denied

Meds: denies

NKDA

SH: denied x3
Case Presentation

VS: T 98.0, BP 146/99, HR 70, RR 18
PE: A&Ox3, NAD. Abd soft, tender in RUQ/epigastric area, neg Murphy’s sign, no rebound, no hernias, non-distended, BS+
Labs:
- CBC: 17.2/13.8/41.2/361, N 90%
- BMP: 135/4.0/96/26/16/0.86/137
- LFTs: 7.6/4.9/27/32/83/0.7, Lipase 167
- Coags: 13.8/26.9/1.4
- UA: neg
EKG: NSR
CXR: wnl
Imaging:
- CT Abd: cholelithiasis 1.7cm in the gallbladder neck with pericholecystic inflammatory changes
- RUQ US: 2.1 cm stone in gallbladder neck, no gallbladder wall thickening, no pericholecystic fluid, negative sonographic Murphy’s sign

Pt was admitted to surgical service, started on IV cipro/flagyl and taken to OR on HD1 for cholecystectomy

Attempted laparoscopic, converted to open cholecystectomy was performed

Gallbladder was thick, edematous, intrahepatic with impacted large stone in the fundus
Gallbladder was entered in order to confirm location of the cystic duct, mucosa appeared gangrenous.

Cystic duct was tied with silk 2-0 suture.

JP drain was left in Morrison’s pouch.

Path: gallbladder with acute, necrotizing, hemorrhagic and chronic cholecystitis with impacted cholelithiasis.

POD1: WBC 12.7, JP 25cc serosang

POD2: WBC 9.9, JP 190cc bilious

POD3: WBC 10.6, JP 500cc serosang

POD4: WBC 11.8, JP 400 bilious, plan: MRCP
MRCP: abnormal small fluid collection adjacent to cystic duct extending into subhepatic space, highly suspicious for cystic duct stump leak, no intrahepatic biliary ductal dilatation

POD8: ERCP, sphincterotomy, common bile duct stent placement

POD9: Amylase 245, Lipase 1005, JP drainage decreased

POD10: Amylase 175, Lipase 615

POD12: WBC 6.8, JP drain removed (10cc), pt discharged

Plan: f/u with GI in 4 weeks to remove stent
In 1867, John Stough Bobb of Indianapolis performed cholecystotomy, removed gallstones and sutured the gallbladder in a 32-year-old woman with massive gallbladder hydrops - first biliary tract operation

In 1882, Carl Langenbuch of Berlin performed first cholecystectomy for a patient with biliary colic

In 1986, Erich Mühe of Germany performed the first laparoscopic cholecystectomy
Anatomy

- Common hepatic duct lays anterolateral to the hepatic artery and portal vein in the hepatoduodenal ligament
- Common bile duct length is 5-9 cm which is divided into supraduodenal, retroduodenal, and intrapancreatic segments
- Gallbladder is a pear-shaped organ which is 7-10 cm in length, 3-5 cm in diameter, and capacity of 30-60 ml
- Cystic duct length is 1-5 cm and diameter 3-7 mm
- An accessory hepatic duct or cholecystohepatic duct (duct of Luschka) may also enter the gallbladder through the gallbladder fossa
Gallbladder is supplied by a single cystic artery, but in 12% of cases a double cystic artery may exist (anterior and posterior).

The origin and course of the cystic artery is one of the most variable in the body: may originate from left hepatic, common hepatic, gastroduodenal, or superior mesenteric arteries.

Cystic artery usually lies superior to the cystic duct and passes posterior to the common hepatic duct.
Anatomy of the Biliary System
Triangle of Calot

- **Boundaries:** common hepatic duct, liver, cystic duct
- **Within triangle:** cystic artery, right heparic artery and cystic duct lymph node
Blood supply to extrahepatic biliary tree originates:
- proximally: right hepatic and cystic arteries
- distally: gastroduodenal and posterosuperior pancreaticoduodenal arteries
- these arteries supply common bile and common hepatic ducts through branches running parallel to the duct in the 3- and 9-o’clock positions

Extrahepatic biliary tree is vulnerable to ischemic injury during dissection and can result in biliary stricture or leak postoperatively.
Symptoms are usually the result of obstruction, infection, or both.

Obstruction can be extramural (e.g., pancreatic cancer), intramural (cholangiocarcinoma), or intraluminal (choledocholithiasis).

Biliary infections are usually due to three factors: susceptible host, sufficient innoculum, and stasis.

Most common symptoms related to biliary tract disease are abdominal pain, jaundice, fever, and nausea and vomiting.
Risk Factors for Gallstones

- Obesity
- Rapid weight loss
- Childbearing
- Multiparity
- Female sex
- First-degree relatives
- Drugs: ceftriaxone, postmenopausal estrogens, total parenteral nutrition
- Ethnicity: Native American (Pima Indian), Scandinavian
- Ileal disease, resection or bypass
- Increasing age


* Obesity is defined as body mass index greater than 30 kg/m².
# Indications for Cholecystectomy

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* Within 24 to 72 hours.
Laparoscopic Cholecystectomy

Contraindications include coagulopathy, severe COPD, end stage liver disease, and CHF.

Major contraindication to completing a laparoscopic cholecystectomy is inability to clearly identify all of the anatomic structures.

Conversion rate for elective laparoscopic cholecystectomy is around 5%.

Conversion rate in the setting of acute cholecystitis may be as high as 30%.

Conversion to an open procedure is not a failure and the possibility should be discussed with the patient preoperatively.
Laparoscopic Cholecystectomy

- Pneumoperitoneum is created with CO2 gas
  - Open technique using Hasson blunt-tipped cannula often used following previous abdominal surgery
  - Closed technique involves use Veress hollow insufflation needle with a retractable cutting sheath
  - No difference in inadvertent bowel or tissue injury between the two techniques

- The laparoscope is placed through a 10-mm port just above the umbilicus
Additional ports are placed under direct vision in the epigastrium and subcostally in the midclavicular and near the anterior axillary lines.
Laparoscopic Technique

The gallbladder is retracted cephalad using the grasper on the gallbladder fundus.

The gallbladder infundibulum is retracted inferolaterally to expose triangle of Calot.

The peritoneum overlying the gallbladder infundibulum, neck and cystic duct is divided bluntly, exposing the cystic duct.

Junction of the gallbladder and cystic duct is identified and dissection continues until the cystic artery and duct are clearly seen entering the gallbladder, visualization of common bile duct is not necessary.

Partial dissection of the base of gallbladder off the liver bed enables identification of all the anatomy and minimizes risk for bile duct injury.
Laparoscopic Technique

- Fundus of gallbladder
- Liver
- Cystic duct and artery
- Subxiphoid instrument position
- Right subcostal lateral and medial instrument positions
Laparoscopic Cholecystectomy

- Clips are placed proximally and distally on cystic artery and duct and both are divided.
- Gallbladder is dissected out of the gallbladder fossa with electrocautery and removed through the umbilical port using plastic specimen retrieval bag.
- Operative field is searched for hemostasis before complete separation of the gallbladder from the liver bed.
- Any bile or blood that has accumulated should be irrigated and suctioned.
- Any concern about bile accumulation or leak should prompt placement of a closed-suction drain and left underneath the right lobe of the liver close to gallbladder fossa.
Open Cholecystectomy

Usually performed either as a conversion from an attempted laparoscopic cholecystectomy or as a second procedure in a patient requiring laparotomy for another reason.

Performed in any patient who cannot tolerate pneumoperitoneum because of poor pulmonary or cardiac reserve and in patients in whom gallbladder cancer is suspected preoperatively.
Indications for Open Cholecystectomy

- Poor pulmonary or cardiac reserve
- Suspected or known gallbladder cancer
- Cirrhosis and portal hypertension
- Third trimester pregnancy
- Combined procedure
Open Technique

- Performed similarly to the laparoscopic approach
- After cystic artery and duct identified, the gallbladder is dissected from the liver bed starting with the fundus
- In retrograde technique dissection is initiated with the fundus and the artery and duct are identified, ligated and divided as a final step
Biliary Leak

Leaks from the cystic duct stump or an unrecognized duct of Luschka may be problematic.

The most common etiology for a cystic duct stump leak is an inflammation around the duct in the setting of acute cholecystitis, which dislodges placed clips.

Bile leaks commonly present shortly after cholecystectomy (within 1 week) with right upper quadrant pain, fever, chills, and hyperbilirubinemia.

CT scan and ultrasound will confirm presence of a complex fluid collection in the right upper quadrant.
Operative intervention with wide drainage is only indicated if the patient is in septic shock.

Attempts at early repair are dangerous and doomed for failure because of the inflammatory response incited by the bile leak.

Percutaneous drainage of intra-abdominal fluid collections followed by an endoscopic biliary stenting resolves most leaks without need for operative intervention.

If bile leaks fail to resolve after 6 weeks, further imaging with MRC and endoscopic imaging may be necessary to rule out a common bile duct injury.
Most benign strictures follow iatrogenic bile duct injury, most commonly during laparoscopic cholecystectomy. Most injuries are recognized intraoperatively or during the early postoperative period. Long-term sequelae of unrecognized or inappropriately managed biliary strictures may lead to recurrent cholangitis, secondary biliary cirrhosis, and portal hypertension.
In open cholecystectomy is 0.1 - 0.2%
In laparoscopic cholecystectomy reported around 0.3-0.85% in several large studies
Factors involved in the occurrence of bile duct injuries include acute or chronic inflammation, obesity, anatomic variations and bleeding
Injury rate is increased in patients with acute cholecystitis, pancreatitis, cholangitis and obstructive jaundice
Inadequate exposure and failure to identify structures before ligating or dividing them are the most common cause of biliary injury
As surgeon experience increases beyond 20 cases, the bile duct injury rate decreases
Common Bile Duct Transection

Classic injury occurs when excessive cephalad retraction of the gallbladder may align the cystic duct with the common bile duct, allowing the latter to be mistaken for the cystic duct.
Biliary Injury

- Electrocautery may lead to thermal injury
- Dissection deep into the liver parenchyma may cause injury to intrahepatic ducts
- Poor clip placement close to hilar area or to structures not well visualized can result in a clip across the bile duct
- Intraoperative cholangiogram may limit the extent of injury, but does not seem to prevent it
Patients with bile duct injuries can present intraoperatively, in the early postoperative period, or months or years after the initial injury.

25% of major ductal injuries are recognized intraoperatively because of bile leakage, an abnormal cholangiogram, or late recognition of the anatomy.

Most common presentation of a complete occlusion of the common bile duct is jaundice with or without abdominal pain.

Patients may also present months or years after the surgery with cholangitis or cirrhosis secondary to a biliary tract injury.
Historically, after open cholecystectomy, 10% of patients presented within the first week, 70% within 6 months, and 80% within 1 year.

In general, patients with a bile leak will present early, whereas patients with postoperative biliary strictures alone present with jaundice or cholangitis months to years after the initial injury.

US or CT should be performed in patients with signs of abdominal pain or peritonitis, sepsis, or any other clinical suspicion of biloma.

Management depends on the timing of the diagnosis and the extent and level of injury.

Inappropriate management of biliary strictures may result in biliary cirrhosis and cholangitis.
Intraoperative Management

- Isolated, small, non-cautery-based partial lateral bile duct injury can be managed with placement of a T tube.
- If the biliary injury is more extensive (e.g. involves >50% of the circumference), an end to side choledochojejunostomy with a Roux-en-Y loop of jejunum should be performed.
- Ducts larger than 3 mm need to be re-implanted, those less than 3 mm can be safely ligated.
- If uncertain or underexperienced, placing a drain followed by referral to an experienced center is the most appropriate course of action.
Suspected common bile duct injury during laparoscopic cholecystectomy

- Intraoperative cholangiogram
  - Partial injury (<30%) to CBD
    - Primary repair over T tube
  - Extensive injury (>30%) to CBD
    - Cautery injury
      - Roux-en-Y choledochojejunostomy
  - Complete transection of CBD
    - >3 mm in size
      - Reimplantation or reconstruct with Roux-en-Y hepaticojejunostomy
    - <3 mm in size
      - Ligate
  - Injury to isolated hepatic duct
    - <3 mm in size
      - Ligate
Successful repair of biliary strictures requires adherence to specific surgical principles:

- Use of proximal bile duct with minimal inflammation
- Creation of a tension-free anastomosis with the use of a Roux-en-Y jejunal limb
- Direct mucosa-to-mucosa anastomosis

Primary repair of the bile duct is associated with a 40-50% long-term failure rate

The use of a Roux-en-Y jejunal limb allows for the creation of an “access loop” for future interventional radiologic access
Multidisciplinary team consisting of experienced interventional radiologist, endoscopist, and experienced hepatobiliary surgeon should plan the following specific goals:

- Control of infection (abscess or cholangitis)
- Drain the biloma
- Complete the cholangiography
- Provide definitive therapy with controlled reconstruction or stenting
Postoperative management

Patients should be stabilized with IV Abx and image-guided percutaneous drainage of any fluid collections.

Cholangiography should be performed to establish the presence of ductal stricture, identify the level of stricture and identify the nature of injury.

ERCP may be easier to obtain in a patient with biliary stricture and cholangitis who requires urgent cholangiography and biliary decompression, however, it is only useful in patients with bile duct continuity.

Cystic duct leaks or small injuries can be treated with endoscopic stenting.

If biliary stricture is too tight to pass with ERCP, PTC may be performed for proximal biliary decompression.
Radiologic and Endoscopic Techniques

- Endoscopic and percutaneous methods of dilation have equivalent efficacy.
- Endoscopic dilation is often used in patients with a dominant extrahepatic stricture causing clinical symptoms.
- Complications are high for both techniques (~35%) and include hemobilia, cholangitis, bile leaks, and pancreatitis.
- Multiple sessions of dilation are often required to achieve long-term success rate.
- Endoscopic stenting and drainage is a successful treatment option for cystic duct leak or small common bile duct leaks following cholecystectomy.
Outcomes

Best results are obtained when the injury is recognized and repaired during the cholecystectomy.

Percutaneous balloon dilation with stenting has a lower success rate than operative repair.

Postoperative injuries identified in the presence of concomitant biliary leak should be repaired once the biliary leak has subsided and tissue planes are less inflamed (usually after 6 weeks).

Common complications of biliary reconstruction include recurrent cholangitis, external biliary fistula, bile leak, and hemobilia and can be managed nonoperatively.

Restenosis of a biliary-enteric anastomosis occurs in ~10% of patients, and may manifest many years later.
If stones are found shortly after the cholecystectomy, they are classified as retained; those diagnosed months or years later are termed recurrent.

Patients will present most commonly shortly after cholecystectomy with sharp, intense right upper quadrant pain and jaundice.

Retained or recurrent stones following cholecystectomy are best treated endoscopically - a generous endoscopic sphincterotomy will allow stone retrieval as well as spontaneous passage of the stones.
Postcholecystectomy pain

Abdominal pain or other symptoms originally attributed to the gallbladder may persist or recur months or years after cholecystectomy.

Patients presenting with right upper quadrant pain, jaundice, and chills shortly after cholecystectomy should be evaluated for retained stones or biliary leak.

Other causes of abdominal pain in patients with normal liver function tests should also be investigated.

Another possibility in a small number of patients with persistent pain following cholecystectomy is abnormalities in the sphincter of Oddi such as stenosing papillitis or sphincter dysfunction.


