

Surgical Management of Cholelithiasis

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ABSTRACT

Background: 15% of adults in the United States suffer from gallstones, with about 1 million cases diagnosed each year. The risk factors leading to a higher risk of developing gallstones include obesity, along with older age and females with multiple pregnancies where 60% of them undergo cholecystectomy. There are various different managements, mainly including open cholecystectomy, laparoscopic surgery, as well as medical treatments.

Aim: In this review, we aim to study the diagnosis, presentation, and different management approach of gall stones, along with their indication and contraindication.

Materials and Methods: We conducted this review using a comprehensive search of MEDLINE, PubMed, and EMBASE, January 2001, through February 2017. The following search terms were used: cholelithiasis, open cholecystectomy, laparoscopic surgery, prophylactic cholecystectomy, medical management of gall stones.

Conclusion: Gallstones are still a major cause of undergoing surgery worldwide. Correct recognition of gall stone disease, with appropriate management technique results in high success rate. Most patients undergo surgery only after they are symptomatic.

Keywords: gall stones, cholelithiasis, open cholecystectomy, laparoscopic surgery, prophylactic cholecystectomy, medical management.

INTRODUCTION

Cholesterol composes most gallstones, which are formed following cholesterol super saturation, cholesterol crystal nucleation acceleration, and/or gallbladder motility dysfunctions. It was estimated that up to 15% of adults in the United States (more than 20 million people) have developed gallstones, with about 1 million cases diagnosed each year. Obese, older, females with multiple pregnancies, have a higher risk of developing gallstones. Risk is also elevated in specific racial and ethnic groups. About 600,000 patients underwent cholecystectomy in 1991 in the United States^[1]. Although, most cases may be asymptomatic, few cases may develop serious (and may be fatal) complications. These complications include: acute cholecystitis, pancreatitis or (rarely) gallbladder cancer. Asymptomatic gallstones are also known as 'silent stones'. After introduction of laparoscopy, the management and treatment of gallstone has improved significantly^[2].

METHODOLOGY

• Data Sources and Search terms

We conducted this review using a comprehensive search of MEDLINE, PubMed, and EMBASE, January 2001, through February 2017. The following

search terms used: *cholelithiasis, open cholecystectomy, laparoscopic surgery, prophylactic cholecystectomy, medical management of gallstones. The study was done after approval of ethical board of King Faisal university.*

• Data Extraction

Two reviewers have independently reviewed the studies, abstracted data, and disagreements were resolved by consensus. Studies were evaluated for quality and a review protocol was followed throughout.

CLINICAL PRESENTATIONS OF GALLSTONE DISEASE

The classic presentation of symptomatic gallstones is a patient with recurrent right upper quadrant pain (sometimes epigastric), that is related to fatty food intake, and most likely at night. This pain comes from an impacted stone in the cystic duct. Pain might be associated with nausea and vomiting, and increases gradually. Pain may radiate to the area between the scapula, or below the right scapula (also called Boas' sign)^[3].

Sometimes, the initial presentation of gallstones may be acute cholecystitis, with secondary infection

by *E. coli*, *Bacteroides* species, or other intestinal flora. Cholecystitis, or inflammation of the gallbladder, causes severe right upper quadrant pain that is often associated with nausea, vomiting, fever, and leukocytosis. Some cases resolve spontaneously, and only need conservative treatment, but few cases can complicate into gangrene or even perforation^[4].

In some cases, the stone become impacted in the common bile duct, causing its obstruction and the development of cholestasis. Jaundice can develop, and infection can occur with this obstruction of bile. These cases are also associated with epigastric or right upper quadrant pain. However, some cases can be painless. Another serious complication is acute pancreatitis that can happen due to transient obstruction of the main pancreatic duct at the ampulla of Vater. Sometimes, the stone can form a fistula from the gallbladder directly into the duodenum, causing the stone to move from the bladder into the small intestine where it will block either the duodenum (Bouveret's syndrome) or the ileum causing gallstone ileus^[2].

DIAGNOSIS OF GALLSTONE DISEASE

The diagnosis of gallstones is mainly based on clinical presentation and patient's history. The presence of recurrent right upper quadrant pain associated with fatty meals, strongly suggests the diagnosis. Other signs that may be present include, fever, right upper quadrant tenderness, Murphy's sign, and Ortner's sign^[5].

After physical examination is done, ultrasonography is considered to be the method of choice in diagnosing cholelithiasis and cholecystitis. It has high sensitivity and specificity and can diagnose even small stones. It can also detect dilation of bile duct, and/or gallbladder wall thickening. Sometimes, plain X-Ray can be used for gallstones diagnosis. Other diagnostic methods are nuclear scanning (cholescintigraphy), and oral cholecystography. Cholescintigraphy is performed by using radioactive material that is absorbable by the bladder, and injecting cholecystokinin which will stimulate the contraction of the bladder. These radioactive products will consequently be excreted with bile, and detected by gamma rays, confirming gallbladder contraction. This technique can also detect complete obstruction of ducts, but it cannot give enough anatomical information, and cannot diagnose stones. The advantages of this method is

mainly when acute cholecystitis is suspected, with high sensitivity and specificity^[6].

To perform oral cholecystography, we give iodinated material orally one day before the test. This material will be absorbed and delivered to the liver, where it will be secreted with bile and concentrated in the bladder. This will show stones, polyps, and/or sludge. In cases of an inflammation in the gallbladder wall, or obstruction of the cystic duct, nothing will be visualized. This test can be used in selected cases where there is a high clinical suspicion with negative or non-conclusive ultrasound^[5].

TREATMENT

Usually, only symptomatic cases with recurrent episodes of pain are usually treated. The definitive treatment is elective cholecystectomy which is recommended and is proved to improve life expectancy^[6].

Prophylactic cholecystectomy

Some specific groups are recommended to have prophylactic cholecystectomy as these groups will definitely develop symptoms later, so performing a prophylactic procedure will be much safer than an emergent one. These populations include children and sickle cell patients, where symptoms of gallstones cannot be distinguished from symptoms of sickle cell crisis^[7]. Sometimes in morbidly obese patients, when cholelithiasis is accidentally found during another surgery, it is also recommended to do cholecystectomy as there is high risk of developing symptoms following the surgery. Some guidelines even recommend cholecystectomy when cholelithiasis in any abdominal surgery in any patient. In groups that have a high risk of gallbladder cancer, like Native Americans with gallstones, any patient with stones for a long time, or with a porcelain gallbladder, it is also recommended to have prophylactic cholecystectomy^[8]. In the past, it was thought that diabetics with gallstones would have improved survival if they undergo prophylactic cholecystectomy. However, it was found recently that they have high risk of complication with elective surgery, and prophylaxis is no longer recommended unless there are symptoms^[9].

Laparoscopy

Laparoscopic cholecystectomy was first introduced more than twenty years ago. Although it was not adopted by many institutes back then, it later

improved and became a revolution in the world of surgery. Laparoscopic cholecystectomy can vary from an easy operation to an advanced complex one. This depends mainly on anatomic status of the patient, the variation between people, and the underlying comorbidities. Sometimes, errors in identifying the organs can make the operation even more difficult and result in complications. The younger generation of surgeons are better with laparoscopic than open surgery, which creates a major problem when these surgeons are put in situations where they need to perform an open surgery^[10].

Indications

Laparoscopy is indicated in symptomatic gallstones with biliary colic, acute/chronic cholecystitis, gallstone pancreatitis, biliary dyskinesia, or other complications and manifestations of gallstone disease^[11].

Contraindications

Laparoscopy is contraindicated in patients who cannot have general anesthesia. Previously, pregnancy, cirrhosis, and coagulopathy were considered a contraindication for laparoscopy, but they are not anymore^[11].

Open cholecystectomy

The first documented cholecystectomy was performed by Carl Johann August Langenbuch, who had practiced this operation on animals before trying on humans. Langenbuch is also considered one of the first to use informed consent in the way we know it today. The first patient to undergo this surgery had an uncomplicated operation, and recovered rapidly, which made Langenbuch perform the surgery on other 24 patients and present his work in 1889 as a new intervention with better outcomes than standard treatment that time. His rationale was that the new operation removed the origin of the symptoms, and prevented further stones formation. In 1894, he published the first volume of (*Surgery of the Liver and Gallbladder*). He later discovered new techniques for choledocholithotomy, choledochoduodenostomy, and cholangioenterostomy. After Langenbuch many debates started about the benefits of cholecystectomy over cholecystostomy which was thought to have decreased morbidities and complications^[12].

Indications

Open cholecystectomy continued to be the best choice and the gold standard of treatment in

gallstones cases, until the introduction of laparoscopic cholecystectomy. Generally, open cholecystectomy is safe with a rate of mortality less than 1% when performed on an otherwise healthy patient. The only limitation is the pain the disability for some weeks following the operation. In 1988, laparoscopic cholecystectomy was performed for the first time, and did not have limitations associated with open cholecystectomy. Since then, it became the standard treatment. However, it is still not acceptable for patients with a history of several abdominal surgeries. In addition, unstable patients who cannot undergo open cholecystectomy, are also not suitable candidates for laparoscopic cholecystectomy^[13].

When suspecting stones in the common bile duct, endoscopic retrograde cholangiopancreatography (ERCP) can be performed to confirm the diagnosis before undergoing laparoscopic cholecystectomy. However, during laparoscopic cholecystectomy, the unexpected discovery of common-bile-duct stones, open surgery is indicated. Other factors associated with the need of an open operation include: patients older than 60 years, males, patients weighing more than 65 kg, acute cholecystitis, a history of prior abdominal surgery, and uncontrolled diabetes^[14].

Another indication of open surgery is the detection of gallbladder mass, as it may be needed to do portal lymph node dissection, en bloc resection of the gallbladder, parts of the liver, or the bile duct. Mirizzi's syndrome and gallstone ileus are also cases in which open surgery is indicated. Gallstone ileus occurs due to the obstruction of the small intestine with a stone that was lodged from the bladder. It also occurs in elderly. Sometimes, and in acute settings, enterolithotomy may be efficient, without the need of a cholecystectomy.

Cholecystectomy, with closure of the fistula might be needed later if patients cannot tolerate the fistula. If a gallstone become impacted in the cystic duct Mirizzi's syndrome occurs, causing compression of the hepatic duct and leading to jaundice, and cholecystobiliary fistula. Czendes's classification of Mirizzi's syndrome determines the operative management of the disease.

To guarantee the safe complete evacuation of stones, and the identification and the closure of the fistula, an open operation is the best option. Another option is the creation of an anastomosis between the gallbladder and the intestines. Some severe cases may need Roux-en-Y hepaticojejunostomy^[15].

Open vs. laparoscopic cholecystectomy

Laparoscopy is associated with lower rates of morbidity, complications, and mortality than conventional open surgery. A previous study found that laparoscopy was associated with 1.9% and 1% morbidity and mortality, respectively, versus open surgery that was associated with 7.7% and 5% morbidity and mortality, respectively.

Acute cholecystitis is associated with higher risks of complications, as it causes anatomical disruption, making it more difficult to identify structures, and increasing the risk of developing common bile duct injury. Another reason for this increased risk is the loss of cleavage plane of the gallbladder, making the liver parenchyma susceptible to perforation during the operation, and increasing the rate of leaks, hemorrhages, and abscesses. This causes increased overall mortality and long term morbidities. In obese patients, laparoscopy carries significant improvement in morbidity and mortality than open surgery, and decreases rates of wound infection, dehiscence, and hernias^[16].

On the other hand, laparoscopy can be associated with several adverse events and complications including bile duct injury, hemorrhage or sub-hepatic abscess, which are less common following open surgery. Injury of the main bile duct is considered the most serious complication that should be strictly monitored. Rates of main bile duct injury are higher in laparoscopy than open surgery, but this difference is not statistically significant. A technique used to avoid this complication is kipping distance of the clip used from the cysticocholedochal junction. Another important complication is hemorrhage due to arterial injury, which is a common cause of conversion into open surgery to manage the situation. Abscesses can be formed following bile leakage or bleeding^[6, 17].

Non-surgical management

Some patients refuse to undergo surgical treatment, or cannot tolerate it. In these cases, non-surgical treatment is initiated. This approach targets stones and tries to dissolve them using oral bile salts. Examples of drugs include Chenodeoxycholic acid (chenodiol) and ursodeoxycholic acid (ursodiol) which are known to dissolve gallstones. However, they are associated with adverse events as diarrhea and abnormal aminotransferase levels. Ursodiol is considered relatively safer and more tolerable. The use of bile salts in treatment is a good option only in few cases of gallstones. In cases of acute

cholecystitis, or the presence of a stone in the common bile duct, emergent surgery is required, and medical treatment is not indicated. When these drugs are stopped, there are high rates of stones recurrence^[18].

Another possible approach is the injection of a solvent like methyl tert-butyl ether within the bladder using a percutaneous catheter. This may help dissolving cholesterol gallstones rapidly. Another possible way is injection it through endoscope into the bladder. These techniques can be difficult and be associated with complications like severe pain. Therefore, only highly experienced physicians are allowed to perform them^[19].

CONCLUSION

In conclusion, gallstones are still a major cause of undergoing surgery worldwide. Gallstones can be classified according to their composition into cholesterol, mixed, or pigment gallstones. Symptomatic cases usually present with right upper quadrant pain that is associated with fatty meals and more common at night. Biliary colic and the presence of stones on imaging confirm the diagnosis of chronic cholecystitis.

Complications of gallstones can include choledocholithiasis, gallstone ileus, and acute gallstone pancreatitis. Normally, treatment is only indicated for symptomatic patients, unless other risk factors for disease progression are present. The general management and treatment of gallstones have not changed much recently. However, the methods and techniques have improved dramatically. Laparoscopic cholecystectomy is considered today as one of the most important interventions in treating gallstones.

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