Modern Techniques in Diagnosis and Treatment of Gall Bladder Stones

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ABSTRACT

Gallstones, also known as cholelithiasis, are one of the most frequent gastrointestinal illnesses. Patients with diabetes mellitus, women around the age of 40, obesity, a high fat and low roughage diet, a lack of exercise, fasting, and patients on hormone therapy or taking oral contraceptives are all at risk. Gallstones are identified by chance during ultrasonography or other imaging of the abdomen in the majority of people who are asymptomatic. Patients who are asymptomatic have a low annual rate of acquiring symptoms (2% per year). Biliary colic, produced by the intermittent occlusion of the cystic duct by a stone, is the most common symptom of simple gallstones once symptoms emerge. The pain is usually continuous, moderate to severe in intensity, and localised in the epigastrium or right upper quadrant of the abdomen. It lasts one to five hours before subsiding. If discomfort persists along with a fever or a high white blood cell count, complications such as acute cholecystitis, gallstone pancreatitis, or ascending cholangitis may be suspected. Ultrasonography is the best initial imaging study for most patients, although additional imaging studies may be indicated. The management of acute biliary colic mainly involves pain control with nonsteroidal anti-inflammatory drugs or narcotic pain relievers. Oral dissolution therapy is usually minimally successful and used only if the patient cannot undergo surgery.

Keywords: Gall Stones, Cholesterol, Cholelithiasis, Cholecystectomy.

INTRODUCTION

Bile is a digestive fluid produced by the liver and discharged into the small intestine. Gallstones are solid chunks of bile that form as a result of changes in bile concentration and composition induced by changes in diet, hormones, drugs, or fast weight loss or increase. Gallstones can sometimes migrate out of the gallbladder, obstructing the normal flow of bile and causing gallbladder inflammation and infection. Cholecystitis is a condition that causes intense, continuous abdominal discomfort, as well as fever, nausea, and vomiting. Patients with cholecystitis or gallstone symptoms are treated with cholecystectomy, which is the surgical removal of the gallbladder. Laparoscopic cholecystectomy, also known as minimally invasive cholecystectomy, is a procedure that involves making four small incisions and using a camera to view the inside of the belly while removing the gallbladder with long tools. Gallstones are concretions that occur in the biliary tract, usually in the gall bladder, and cause cholelithiasis. It takes years to develop and is asymptomatic for decades. During gallbladder contraction, a gallstone may migrate into the cystic duct opening, blocking the outflow of bile. The ensuing rise in gall bladder wall tension causes biliary colic, a specific sort of discomfort.

Gallstones are a type of gallstone that forms in the gallbladder. The gallbladder is a tiny, pear-shaped organ found directly below the liver in the upper right abdomen.

Gallstones can be as small as a grain of sand or as large as a golf ball. A single giant gallstone, hundreds of little stones or both small and large stones can form in the gallbladder. Gallstones can cause pain in the upper right abdomen that comes on suddenly. Gallstones obstruct the channels of the biliary tract, causing discomfort known as gallbladder attack or biliary colic. The gallbladder and bile ducts make up the biliary tract. Bile and other digestive enzymes are transported from the liver and pancreas to the duodenum, which is the first segment of the small intestine.

Bile is a fluid produced by the liver that helps the body digest fats and fat-soluble vitamins A, D, E, and K excrete toxins and waste products out of the body. Cholesterol, bile salts, phosphor lipids, and bilirubin make up the majority of bile. When haemoglobin in red blood cells breaks down, bilirubin, a reddish-yellow compound, develops. Bile excretes the majority of bilirubin. The major route of excretion of cholesterol is bile, through bile acids and bile salts.

Gallstones' scope and causes: Gallstones are caused by imbalances in the chemicals that make up bile. If bile contains too much cholesterol, too much bilirubin, or not enough bile salts, gallstones can form.

The three types of gallstones are cholesterol mixed and pigment stones:

1. Cholesterol stones are made up mostly of hardened cholesterol and are usually yellow-green in hue. More than 80% of gallstones in the United States are cholesterol stones.[1]
2. Calcium bilirubinate is used to make pigment stones,

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which are black in colour.

3. Mixed stones that have been combined (calcium carbonate, palmitate phosphate, bilirubin and other ca salt)

Because of the calcium concentration, mixed stones are radiologically detectable.

Birth control pills, pregnancy, obesity, liver disease, and other variables are also risk factors. Cholelithiasis is more common in fair, fatty, obese fertile, female in their forties (5F)

When bile contains too much cholesterol and not enough bile salt, cholesterol gall stones form. Bile can get over concentrated and form gall stones if the gall bladder isn't emptied completely and on a regular basis. Gallstones in the gallbladder can lead to fibrosis and loss of function a situation.

Risk of developing gallstones

Gallstones are more common in women than in men. Extra oestrogen can cause gallstones by increasing cholesterol levels in bile and decreasing gallbladder contractions. Extra oestrogen may be present in women as a result of pregnancy, hormone replacement medication, or birth control pills.

People with a family history of gallstones have a higher risk. Indians have genetic factors that increase the amount of cholesterol in their bile.

Gallstone disease is influenced by a number of factors.

Obesity: Obese people, particularly women, are more likely to develop gallstones. Obesity raises cholesterol levels in the bile, which can lead to stone formation.

Rapid weight loss

The liver secretes more cholesterol into bile as the body burns down fat during prolonged fasting and rapid weight loss. Rapid weight loss might also make it difficult for the gallbladder to empty correctly. Low-calorie diets and bariatric surgery, which restricts how much food a person can eat or digest, result in rapid weight reduction and a higher risk of gallstones.

Diet

According to our findings, a high-calorie, refined-carbohydrate diet with little fibre increases the incidence of gallstones. Grain that has had the bran and germ removed, (which include minerals and fibre) is known as refined carbs. White bread and white rice are examples of refined carbs.

Certain intestinal diseases: Certain intestinal diseases

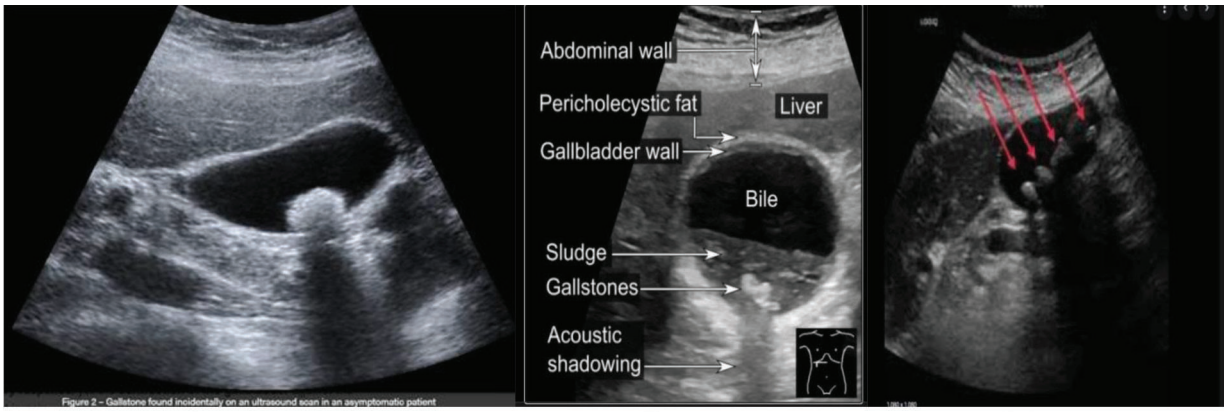
Diseases that affect normal absorption of nutrients, such as Crohn's disease, are associated with gallstones.

Metabolic syndrome, diabetes, and insulin resistance

Gallstones are more likely to form as a result of these situations. Gallstone problems are also more common in those with metabolic syndrome. Metabolic syndrome is a collection of characteristics and medical issues that are associated to being overweight or obese, putting people at risk for heart disease and type 2 diabetes.

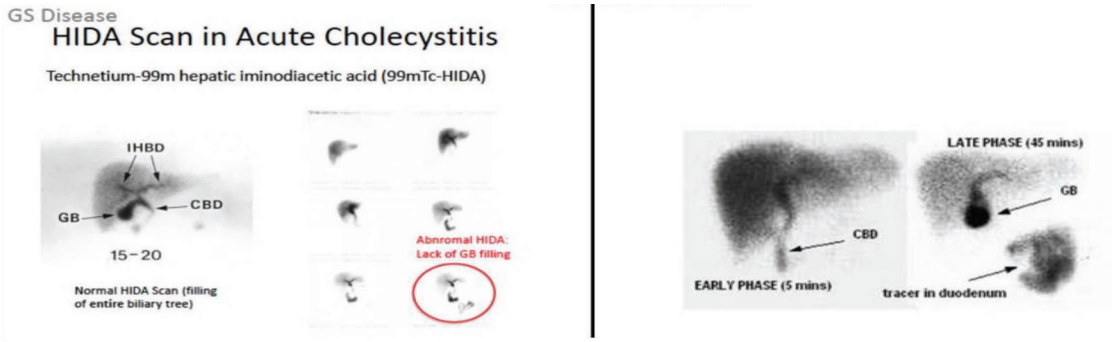
Diagnostic study	Accuracy	Comment
Ultrasonography	High specificity (> 98%) and sensitivity (> 95%) for identifying gallstones; false-negative rate of 1% to 4%	Inexpensive; noninvasive; first-line test for patients with suspected gallstones or acute cholecystitis; provides anatomic information, such as presence of polyps, common bile duct diameter, and parenchymal hepatic abnormalities
Hepatobiliary iminodiacetic acid scan	High sensitivity (97%) and specificity (77%) for the diagnosis of acute cholecystitis; normal findings virtually rule out acute cholecystitis	Useful to visualize the biliary tree and to assess liver and gallbladder function; can diagnose or rule out biliary dyskinesia
		Hepatobiliary iminodiacetic acid is normally taken up by the liver and excreted into bile, where it fills the gallbladder and can be detected with a gamma camera; failure of hepatobiliary iminodiacetic acid to fill the gallbladder at two hours after injection is indicative of cystic duct obstruction
Magnetic resonance cholangiopancreatography	High sensitivity (97%) and specificity (98%) for identifying gallstones	Noninvasive; can identify gallstones anywhere in the biliary tract
		Reserved for cases in which choledocholithiasis is suspected
Computed tomography	Sensitivity of 79% and specificity of 100% for identifying gallstones	Superior to ultrasonography in visualizing the biliary tree and distal common bile duct, but higher cost and radiation exposure make it a second-line option to ultrasonography
Endoscopic retrograde cholangiopancreatography	Sensitivity of 85% to 87% and specificity of 100% for determining normal biliary system, bile duct obstruction, and choledocholithiasis	In studies was 94% effective for stone removal
		Diagnostic and therapeutic; usually performed in conjunction with endoscopic retrograde sphincterotomy and gallstone extraction
Plain abdominal radiography	—	Useful for excluding other causes of acute abdominal pain (e.g., intestinal obstruction, visceral perforation, renal stones, chronic calcific pancreatitis)

Table-1: Diagnostic Study for Gallstones and Complications of Gallstones[6-7]



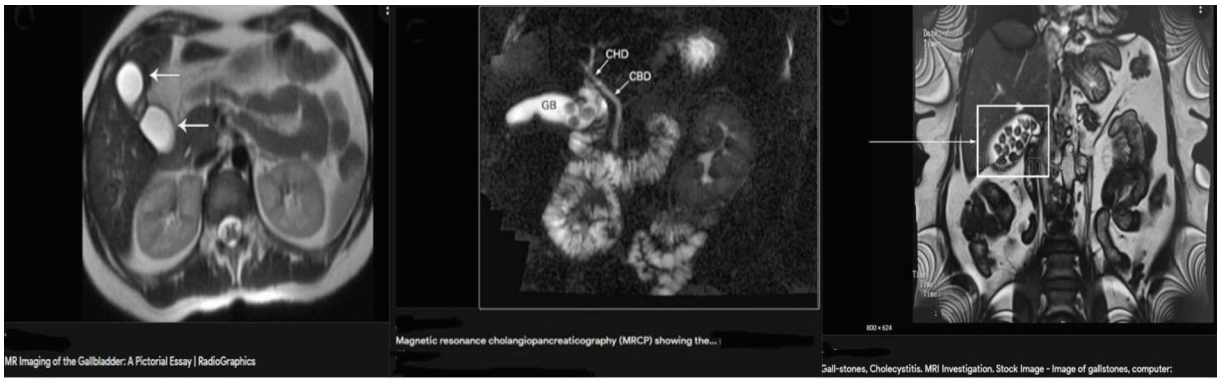
(a) (b) (c)

Figure-1: (a) gallstones with acoustic; (b) showing gall bladder gall stones with sludge; (c) multiple translucent gall stones



(a) (b)

Figure-2: (a) & (b) HIDA Scan with acute cholecystits

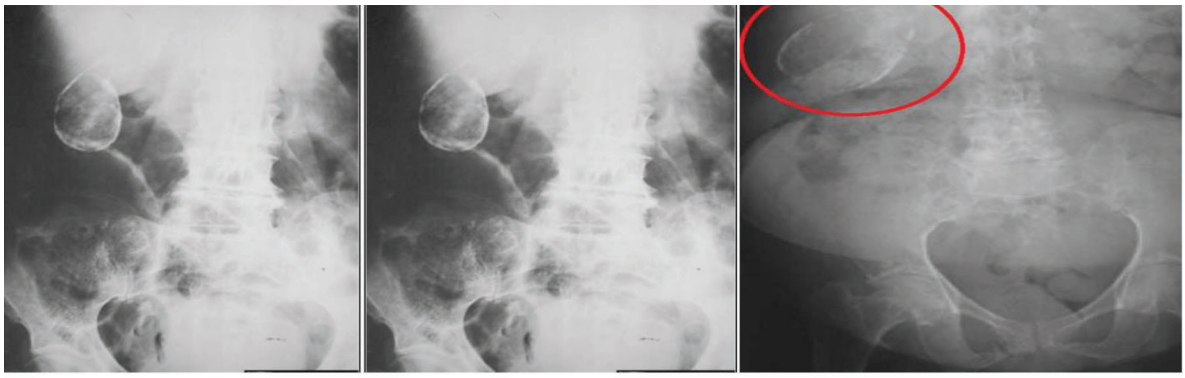


(a) (b) (c)

Figure-3: (a) MRCP imaging of gall bladder; (b) MRCP showing filling defect in CBD with dilated billary channel; (c) gall bladder is filled with multiple calculi

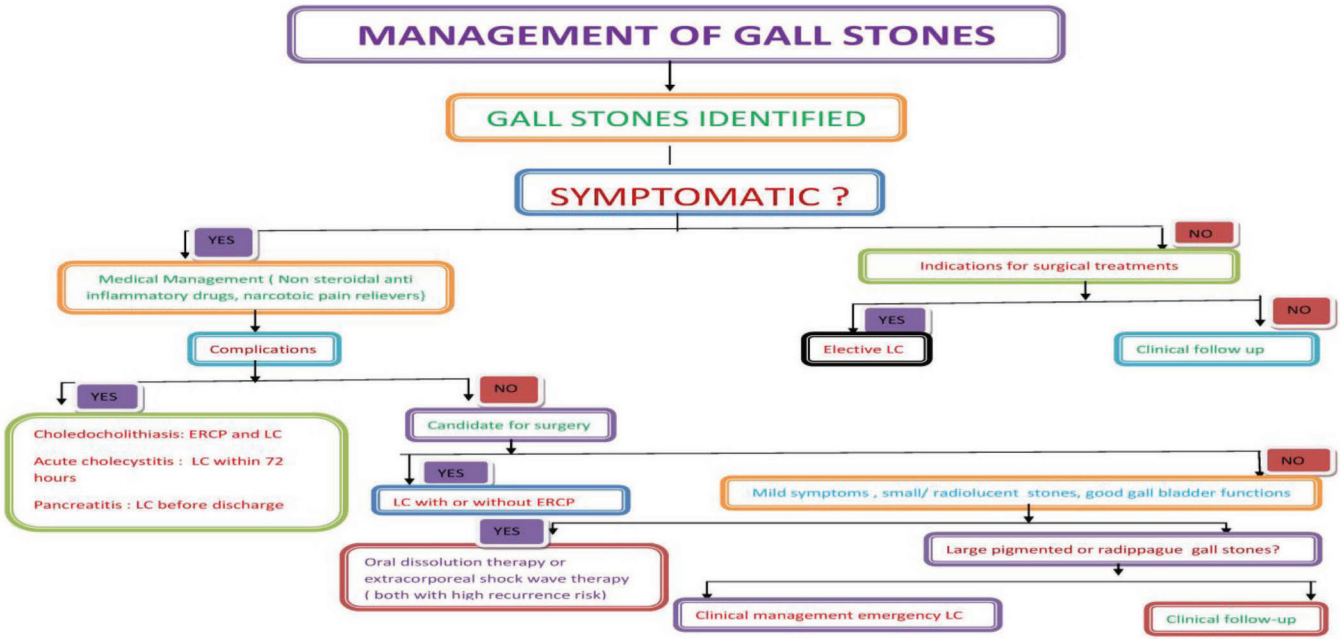
(a) **(b)** **(c)**

Figure-4: (a) ERCP Showing gall stones; (b) dilated hepato billary channels (cholecystecomy after ERCP); (c) gall bladder stones (multiple calculi)



(a) (b) (c)

Figure-5: (a), (b) & (c) X -ray Abdomen showing porcelain gall bladder due to limely bile



Flow chart-1: Management of Gall stones

Ultrasonography

Ultrasonography [8-10] is a non-invasive technology that produces tomographic images of inside body structures by using high-frequency sound waves. It has a wide range of applications in medicine and is a useful diagnostic tool. For GB stone, Acalculous cholecystitis, acute, and chronic cholecystitis, ultrasonography has become the investigation of choice. A normal gallbladder sonography produces a thin linear echo with a thickness of up to 3 mm. Ultrasound can identify wall thickening caused by persistent inflammation or edema

HIDA scan

Hepatobiliary scintigraphy is a diagnostic nuclear medicine procedure which uses radiotracers to evaluate the biliary system and also, indirectly, the liver. The radiotracer used is iminodiacetic acid (IDA) or some close variant which is administered intravenously, bound to albumin, transported to the liver, and excreted into the biliary system. The utility of hepatobiliary IDA or HIDA scan is that the radiotracer follows the bilirubin metabolic pathway and excretion into the bile ducts.[1-3]

A HIDA scan reveals cystic duct obstruction, the underlying main event, which is instantly visible. Because ultrasonography is commonly available, portable, rapid, involves minimal patient preparation, avoids ionising radiation, and may offer alternative diagnosis, scintigraphy is unlikely to replace ultrasound as the first modality for right upper quadrant pain.minimal patient preparation, avoids ionizing radiation, and may offer alternative diagnoses.

MRI imaging

Magnetic resonance imaging (MR imaging) [11-14] software, hardware, and contrast media have advanced to the point that it can be utilised as the primary imaging modality for evaluating pain, jaundice, or mass, as well as a problem-solving tool for gallbladder illness. Furthermore, using contrast compounds excreted preferentially via the biliary system, MR imaging enables for functional assessment of the gallbladder.

Endoscopic retrograde cholangio-pancreatography (ERCP) is a sophisticated endoscopic examination that has been used to treat pancreatic and biliary tract problems. It is used to diagnose and treat CBD stones up to 1.5 cm in

diameter. It is also used to stent distal biliary strictures. On X-ray images, ERCP employs a dye to highlight the bile ducts. An endoscope is a tiny, flexible tube with a camera on one end that is passed down the mouth and into the small intestine. A short hollow tube (catheter) inserted via the endoscope delivers the dye to the ducts. If gallstones obstruct the bile ducts, a variety of balloons and baskets coupled to catheters can be inserted into the ducts to remove the stones. Plain abdominal radiography: Although a simple abdomen [15] X-ray can be utilised to identify calcified gall stones (only 15-20% of gall stones are calcified), the X-ray has little use. A conventional X-ray can also reveal a porcelain(bn gall bladder

Laboratory studies

Laboratory studies recommended for patients with suspected complications of gallstones include a complete blood count and measurement of hepatic transaminase, total bilirubin, alkaline phosphatase, amylase, and lipase levels. Although modest leukocytosis is common in patients with acute cholecystitis, the lack of leukocytosis does not rule out the diagnosis. Gallstone pancreatitis is suspected when amylase and lipase levels are elevated, or when liver function tests reveal abnormal results. A high white blood cell count could signal a gangrenous or perforated gallbladder or other pathology.

Management of Gall stones

Prevention and Treatment

Prevention

People should eat healthy diet – high fiber and good fats (fish oil and olive oil, avoid refine carbohydrates and trans fats)

Get regular exercises – at least 30 min exercise for five days a week, (It boost metabolic activity and preventive for diabetes, hyper tension and other metabolic disorders.

Avoid diet that loose lot of weight in short time.

If women has high risk (5F) better to avoid use of hormonal birth control pills.

Treatment

Cholecystectomy: A cholecystectomy is a surgery that removes the gallbladder. Cholecystectomy treatment of choice for gall stones.[16]

Open Cholecystectomy: The gallbladder is removed through a large (about 6 inch) abdominal incision (cut). This is not the preferred method unless cancer is known or suspected too.

Laparoscopic Cholecystectomy: Many small incisions (cuts) are made in the abdomen. A laparoscope (lighted tube), placed through the incisions, is used to remove the gallbladder.

Nonsurgical Treatments for Cholesterol Gallstones

Nonsurgical treatments are used only in special situations, such as when a person with cholesterol stones has a serious medical condition is not suitable for surgery. Gallstones often recur within 5 years after nonsurgical treatment.[16]

Two types of nonsurgical treatments can be used to dissolve cholesterol gallstones:

Oral dissolution therapy: Ursodiol (Actigall) and chenodiol (Chenix) are medications that contain bile acids that can dissolve gallstones. These medications are most effective in dissolving small cholesterol stones. Months or years of treatment may be needed to dissolve all stones.

Shock wave lithotripsy: A machine called a lithotripter is used to crush the gallstone. The lithotripter generates shock waves that pass through the person's body to break the gallstone into smaller pieces. This procedure is used only rarely and may be used along with ursodiol.

CONCLUSION

Cholelithiasis is the most common cause of gallbladder illness. Gallstones are usually asymptomatic, although certain cases might progress to clinical illness. Gender, ethnicity, medical history, family history, and diet and nutrition are all factors that may raise the risk or susceptibility to gallbladder disease. Imaging techniques are used to diagnose gallbladder disease[17]. These diagnostic methods have advantages and disadvantages, and their accuracy varies. Depending on the type of gallbladder illness or the presenting symptoms, one approach may be recommended over another. In many cases, asymptomatic people do not require treatment. Although surgery is the most prevalent treatment, there are nonsurgical options for those who cannot or do not want to undergo surgery.

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