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Cholelithiasis-An Exploratory Study on Pre-Disposing Component, Pathogenesis & Management in Clinical Precaution Setting

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Abstract

Cholelithiasis is one of the most common disorders and a major source of abdominal morbidity around the world. The presence of one or more gallstones in the bile duct is known as cholelithiasis. Gallstone disease is spreading globally as a result of dietary changes, lifestyle changes associated with excessive junk food consumption, and an increase in sedentary behavior. Gallstone disease is more common in women due to hormonal imbalances. Obesity, diabetes mellitus, and hormonal imbalance are all risk factors for gallstone formation. Cholelithiasis is a serious medical condition that necessitates surgery. However, the technique of therapy has evolved drastically, and laparoscopic cholecystectomy is now gaining popularity. The review focuses on pre-disposing factors, pathogenesis, and management of Cholelithiasis patients.

Keywords: Gallstones, Cholelithiasis, Pre-disposing, Cholecystectomy.

I. Introduction of Cholelithiasis

The gallbladder is a small organ that situated underneath the liver. Bile is a digestive fluid that is stored in the gallbladder and discharged into the small intestine. [1] The presence of one or more gallstones in the common bile duct is defined as cholelithiasis, often known as gallstone disease. Gallstones are solidified deposits of bile that come in a variety of sizes and shapes.[2] Gallstones can be as minute as a flake of grit or as large as a tennis ball, and patients may have one enormous gallstone, hundreds of minor stones, or a combination of both.[3] Gallstones form when the chemical contents of bile are out of balance, causing one or more of the components to precipitate.[4] Gallstones, referred known as cholelithiasis, are stones made up of cholesterol, bilirubin, and bile that form in the gallbladder. In most instance, these stones are

asymptomatic, and they are discovered by chance. Patients with symptoms include right upper stomach pain, nausea, vomiting, and pain in the epigastrium that extends to the right scapula or mid-back after eating oily or spicy meals.

Gallstone complications include cholecystitis, cholangitis, choledocholithiasis, gallstone pancreatitis, and cholangiocarcinoma in rare circumstances. Patients with chronic gallstones may experience gallbladder fibrosis and loss of motor function, culminating in cholecystitis, or gallbladder inflammation. [5] Acute or chronic cholecystitis can occur, with recurring episodes of acute inflammation leading to chronic cholecystitis, the most prevalent condition linked with gallstones. 90 percent to 95 percent of chronic cholecystitis patients are caused by cholelithiasis. Insufficient evidence suggests that those with chronic cholecystitis are more likely to acquire gallbladder cancer, presumably because both illnesses are associated with inflammation. [6,7]

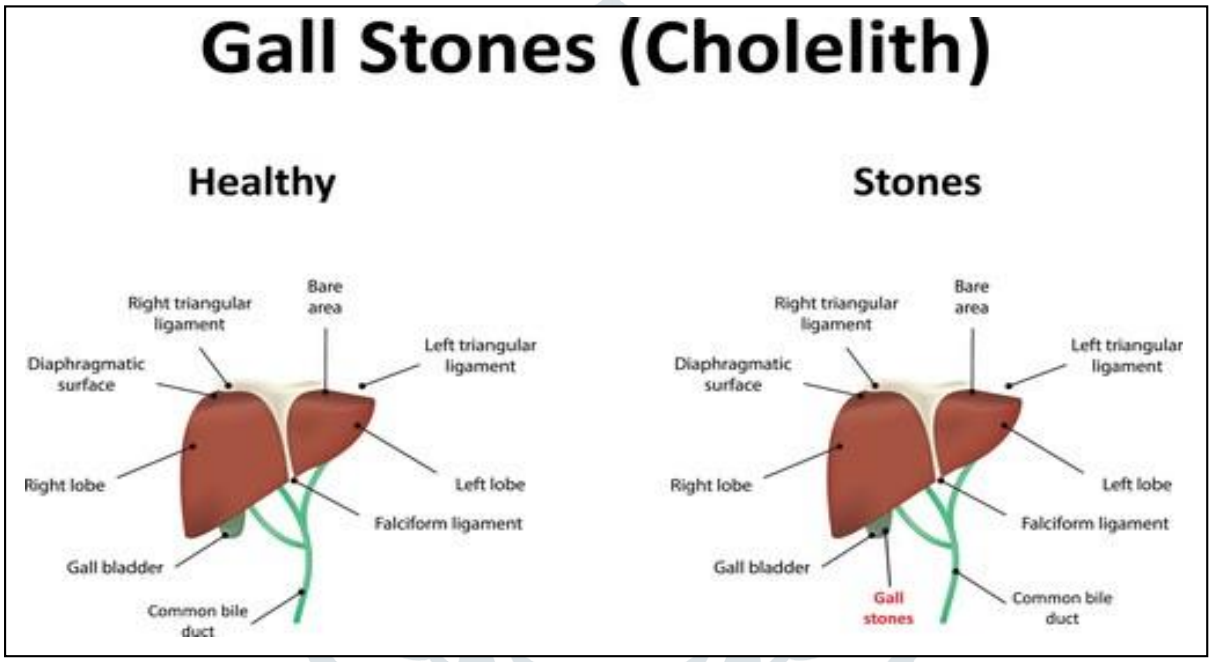

Fig. 1 Gall Stones in Healthy and Infected Liver

II. Epidemiology of Cholelithiasis

Gallstone disease was formerly thought to be a Western condition. [5] It is believed that 20–25 million adults in the United States are affected.[8] Eighty percent of people with gallstones who develop symptoms have biliary colic.[9] Gallstone disease and associated consequences (cholecystitis, pancreatitis, and cholangitis) are the leading causes of gastrointestinal morbidity and hospitalization.[10] Gallstone disease is more common in older people and women. Clinically, the incidence of gallstone disease has increased over the last decade, coinciding with an increase in calorie and fat consumption, a decrease in fiber intake, and an increase in the prevalence of the population's sedentary lifestyle.[11] According to specialists, the obesity phenomenon has likely intensified the rise in gallstones. Cholelithiasis is rather prevalent, affecting roughly 6% of men and 9% of women. Gallstones are uncommon in Africa and Asia. Gallstones are prevalent, with prevalence rates ranging from 60% to 70% in American Indians and 10% to 15% in white adults in affluent countries. Cholelithiasis is the most prevalent inpatient diagnosis among patients with gastrointestinal and liver diseases.[12,13] It is also one of the most expensive digestive disorders for the healthcare system, as well as the leading cause of death from gastrointestinal nonmalignant disease.[14]

Certain gallstone risk factors are unchangeable: feminine gender, advancing age, and ethnicity/family pedigree. Obesity, metabolic syndrome, rapid weight loss, some disorders (cirrhosis and Crohn disease), gallbladder stasis (from spinal cord damage or medicines like somatostatin), and lifestyle are all controllable. Gallstones triggered by cholesterol are becoming more prevalent, along with other metabolic disorders such as insulin resistance and type 2 diabetes, enlargement of visceral adiposity as a result of overweight and obesity, and metabolic syndrome.[15]

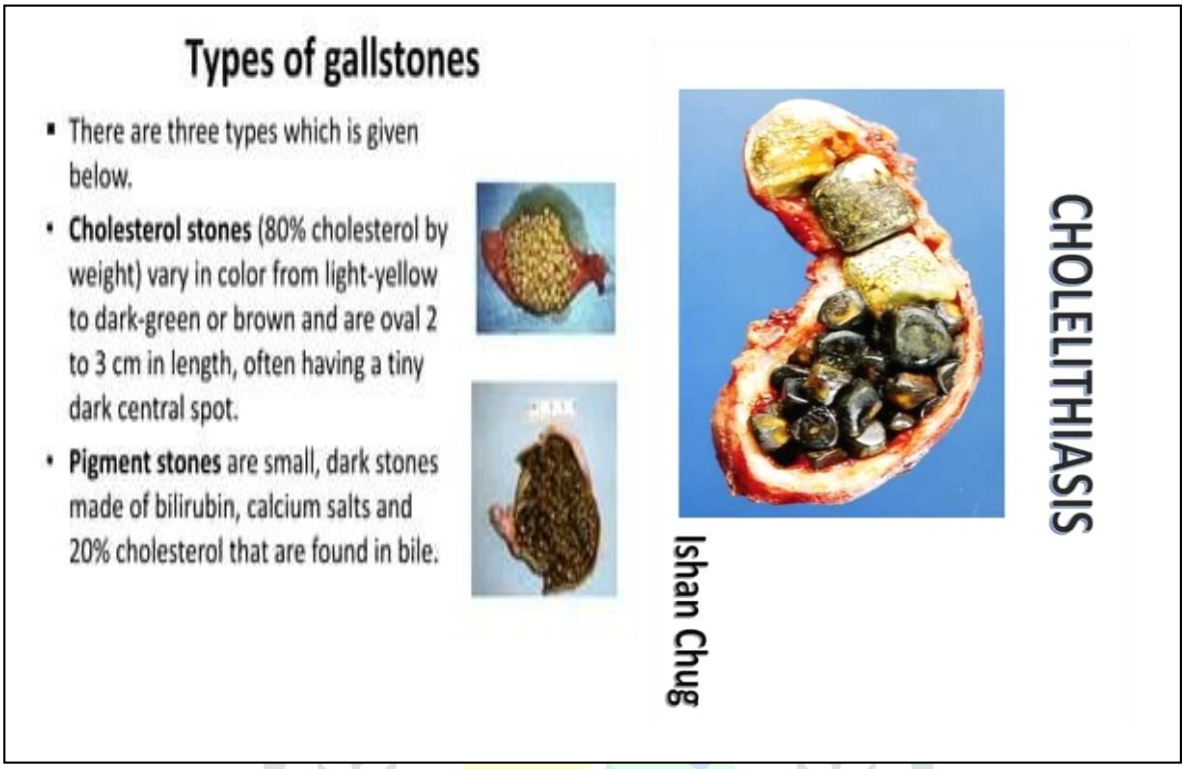

Fig. 2 Various Types and Size of Gall Stones

III. Types of Cholelithiasis

Gallstones are mostly made up of cholesterol, bilirubin, and calcium salts, with trace amountsof protein and other substances.[16]

Gallstones are classified into three categories.[17]

- Pure cholesterol stones consisting at least 90% cholesterol
- Pigment stones, either brown or black, containing at least 90% bilirubin
- Stones of mixed composition,

They contain different amounts of cholesterol, bilirubin, and other ingredients such as calcium carbonate, calcium phosphate, and calcium palmitate.[2] Brown pigment stones are mostly calcium bilirubinate, whereas black pigment stones are constituted of bilirubin, calcium, and/or tribasic phosphate.[18] Pure cholesterol crystals are fairly soft, and protein exerts a crucial role in the strength of cholesterol stones.[19]

IV. Cholelithiasis-symptoms and complications

In the majority of cases, there are hardly any symptoms of growth of stones in your gallbladder. They may be merrily swimming around in the stored bile, causing you no harm or pain or discomfort, not giving any inkling of their existence. In this condition, stones in the gallbladder continue to remain unknown

unless revealed through an ultrasonography examination. Here are some of the symptoms and complications that may indicate the presence of gallbladder stones:

- Sudden and intense pain in the upper right part of the abdomen.
- Intense and rapidly increasing pain in the central portion of the abdomen below the breastbone.
- Pain in between the shoulder blades
- Sharp pain in the right shoulder
- Feeling nauseous or vomiting.

When gallstone (s) block a biliary duct you start feeling the pain. About 10 – 22% of just the female population in India are estimated to have gallstone disease. Here are some complications which may arise if gallbladder stones are left untreated:

- The stones in your gallbladder may result in complications like cholecystitis (inflammation of the gallbladder), leading to a tear in the gallbladder.
- Obstruction of bile duct leading to jaundice.
- Ice.

V. Risk factors for growing stones in your gallbladder

There are hardly any specific reasons for the formation of gallstones. Some of the reasons attributed to the formation of stones in the gallbladder include:-

- Obesity
- Fat or cholesterol-rich diet
- Simply being a female

A study corroborates that women are at higher risk of growing gallbladder stones due to pregnancy and sex hormones. Secretion of biliary cholesterol is associated with estrogen, which is a group of hormones which play a vital role in aiding the reproductive development in women and maintaining normal sexual health. This results in super-saturation of bile with cholesterol rendering the bile lithogenic, i.e. prone to the formation of stone. The study further concluded that heaviness or obesity in the abdominal region, lack of physical activity and high intake of foods rich in saturated fats were the most common factors in the cases forming part of the cited study on “Lifestyle and Gallstone Disease”.

VI. Complication of Cholelithiasis

If a gallstone blocks the flow of bile through your biliary system, it can affect any or all of the organs in that system. Bile that can’t flow backs up into your bile ducts and organs, causing acute inflammation and encouraging bacterial infections. When severe, these conditions can become life-threatening.

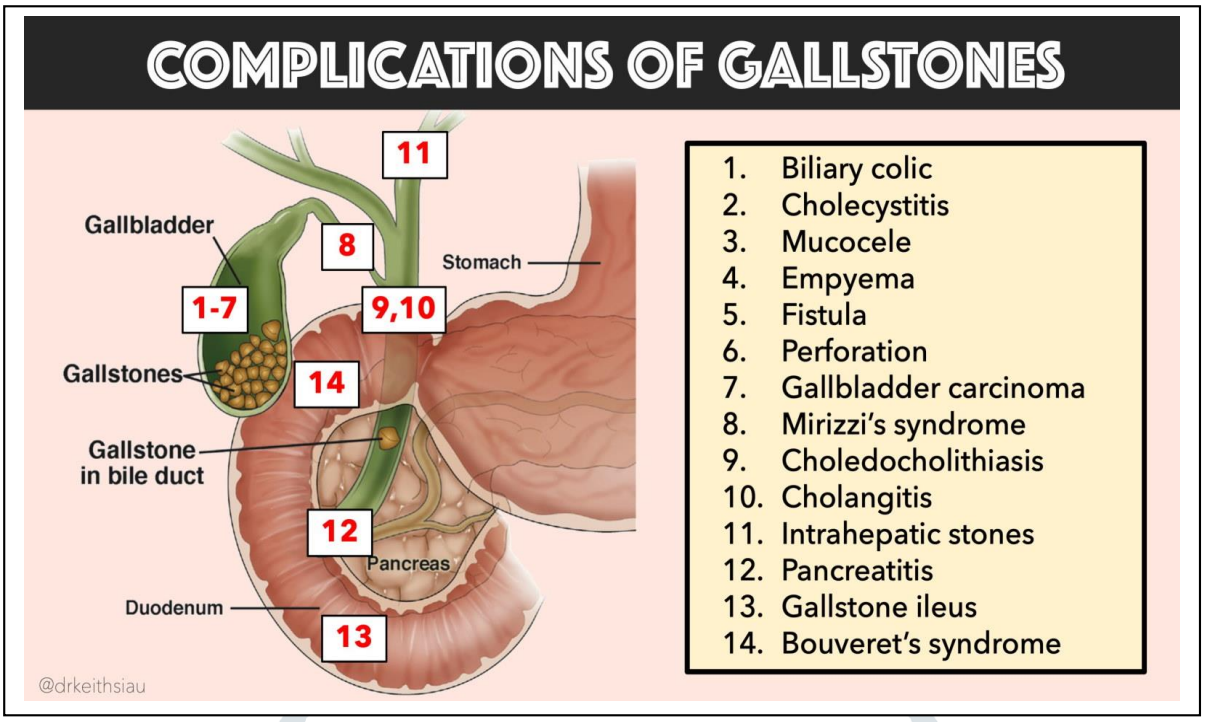

Fig. 3 Complication of Gall Stones

Complications include:

- Cholecystitis (gallbladder inflammation)
- Pancreatitis (pancreas inflammation)
- Cholangitis (bile duct inflammation)
- Hepatitis (liver inflammation)
- Jaundice (bile in your bloodstream)
- Septicemia (an infection in your bloodstream)

Dizziness and fatigue are symptoms of low blood pressure. These aren't typical symptoms of gallstones. However, low blood pressure is a possible side effect of gallstone complications. Severe inflammation or infection in your biliary system could trigger a faster heart rate along with a drop in blood pressure.

VII. Diagnosis of Cholelithiasis

Ultrasonography :

Gallstones are suspected in patients with biliary colic. Abdominal ultrasonography is the imaging test of choice for detecting gallbladder stones; sensitivity and specificity are 95%. Ultrasonography also accurately detects sludge. CT and MRI are alternatives. Endoscopic ultrasonography accurately detects small gallstones (< 3 mm) and may be needed if other tests are equivocal. Laboratory tests usually are not helpful; typically, results are normal unless complications develop. Asymptomatic gallstones and biliary sludge are often detected incidentally when imaging, usually ultrasonography, is done for other reasons. About 10 to 15% of gallstones are calcified and visible on plain x-rays.

VIII. Treatment of Cholelithiasis

- For symptomatic stones: Laparoscopic cholecystectomy or sometimes stone dissolution using ursodeoxycholic acid
- For asymptomatic stones: Expectant management

Most asymptomatic patients decide that the discomfort, expense, and risk of elective surgery are not worth removing an organ that may never cause clinical illness. However, if symptoms occur, gallbladder removal (cholecystectomy) is indicated because pain is likely to recur and serious complications can develop.

IX. Surgery of Cholelithiasis

Surgery can be done with an open or a laparoscopic technique. Open cholecystectomy, which involves a large abdominal incision and direct exploration, is safe and effective. Its overall mortality rate is about 0.1% when done electively during a period free of complications.

Laparoscopic cholecystectomy is the treatment of choice. Using video endoscopy and instrumentation through small abdominal incisions, the procedure is less invasive than open cholecystectomy. The result is a much shorter convalescence, decreased postoperative discomfort, improved cosmetic results, yet no increase in morbidity or mortality. Laparoscopic cholecystectomy is converted to an open procedure in 4 to 8% (1) of patients, usually because biliary anatomy cannot be identified or a complication cannot be managed. Older age typically increases the risks of any type of surgery.

Cholecystectomy effectively prevents future biliary colic but is less effective for preventing atypical symptoms such as dyspepsia. Cholecystectomy does not result in nutritional problems or a need for dietary limitations. Some patients develop diarrhea, often because bile salt malabsorption in the ileum is unmasked. Prophylactic cholecystectomy is warranted in asymptomatic patients with cholelithiasis only if they have large gallstones (> 3 cm) or a calcified gallbladder (porcelain gallbladder); these conditions increase the risk of gallbladder carcinoma.

X. Stone dissolution in Cholelithiasis

For patients who decline surgery or who are at high surgical risk (eg, because of concomitant medical disorders or advanced age), gallbladder stones can sometimes be dissolved by ingesting bile acids orally for many months. The best candidates for this treatment are those with small, radiolucent stones (more likely to be composed of cholesterol) in a functioning nonobstructed gallbladder (indicated by normal filling detected during cholescintigraphy or by absence of stones in the gallbladder neck).

Oral ursodeoxycholic acid dissolves 80% of tiny stones < 0.5 cm in diameter within 6 months [2]. For larger stones (the majority), the success rate is much lower, even with higher doses of ursodeoxycholic acid. Further, after successful dissolution, stones recur in 50% of patients within 5 years. Most patients thus prefer laparoscopic cholecystectomy. However, oral ursodeoxycholic acid can help prevent stone formation in morbidly obese patients who are losing weight rapidly after bariatric surgery or while on a very low calorie diet. Stone fragmentation (extracorporeal shock wave lithotripsy) to assist stone dissolution and clearance is rarely done.

XI. Herbal Drugs used in the management of Cholelithiasis

A. Plant-based foods

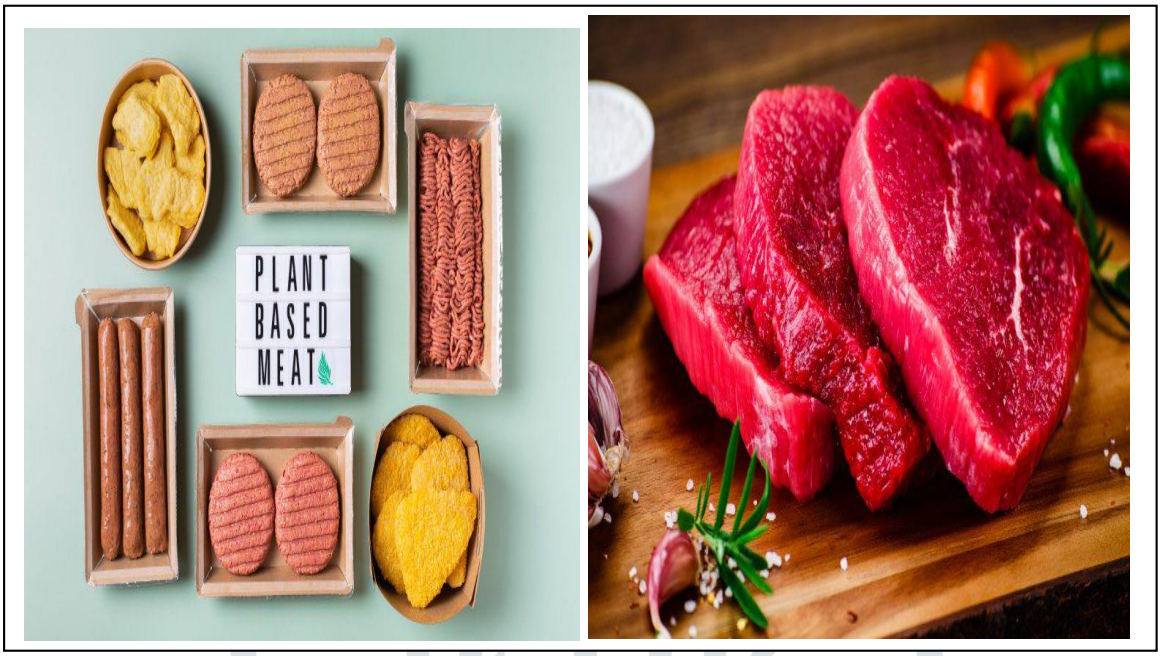

Fig. 4 Plant base food and lean protein used in Gall stone

It is common knowledge that plant-based foods are rich in nutrients, which are essential for the body to stay healthy and functional. They also provide vitamins, minerals and antioxidants in ample. These antioxidants mainly flush out toxins and free radicals from the body. These develop due to the natural bodily processes and consumption of processed food. A high accumulation of toxins can break down the body's natural balance and can cause cell damage. These plant-based foods offer the nutrition needed to get better and help reduce the stress caused to the digestive system. Another advantage is that plant-based foods decrease the risk of cholesterol in a person, which may help manage cholesterol gallbladder stones.

B. Lean protein

Including a source of protein that is low in saturated fat might help lower the bad cholesterol amounts in our body. Red meat, a good source of protein, is high in fat, which can put stress on the gall bladder. Thus, choosing lean protein sources might help you manage the symptoms of gall bladder stones. Some common options are:

- Low-fat milk and dairy products.
- Nuts and seeds like almonds.
- Dairy alternatives like almond milk, oat milk and soy milk.

You should also avoid processed meats and dairy products as they generally have higher salt content. According to a study published in the database of the National Institutes of Health, a higher intake of vegetable protein might help lower the risk of gall bladder conditions.

C. Fibre-rich foods

Fig. 5 Fibrous food & Dairy food used in Gall stone

Fibrous food is essential for good digestive health and enhances the movement of food through our gut. Thus, fibre-rich foods help lower the productions of secondary bile acids, which can help decrease the stress on the gall bladder. According to a study published in the National Library of Medicine, a high-fibre diet helped decrease the production of biliary sludge. An increase in the amount of this sludge means an increase in the risk of gall bladder diseases. Thus, people who follow a fibre-rich diet might be at a reduced risk of gallbladder stones. It also suggests that a fibre-rich diet might offer relief to people affected with gall bladder stones. Some sources of fibre are:-

Whole fruits and vegetables

- Legumes like lentils and chickpea
- Nuts, seeds and whole grains

D. Vitamin C

According to a Hospital Case Study published by the National Library of Medicine, Vitamin C, Magnesium and Folate can help reduce the risk of gall bladder diseases and improve your gall bladder health. Some sources high in Vitamin C are:-

- Citrus fruits like lemons oranges and grapefruits
- Vegetables like broccoli and red and green peppers
- Other fruits like kiwis and strawberries

Fig. 6 Vitamin C food used in Gall Stone

XII. Foods avoid in Cholelithiasis

Now that we know about what foods we should include in our diet for a healthy gall bladder let us look at some we should avoid.

A. Refined bread and carbohydrates

Unrefined carbohydrates are considered to be healthy and some sources, like whole grains and cereals, can provide essential nutrients. However, refined carbohydrates are more difficult to digest and may increase the risk of gall bladder diseases. Some carbohydrates that you need to steer clear of are:-

- Processed baked items
- Added sugars, sweeteners and chocolates
- White Flour and Refined Grains

B. Saturated and Trans fats

The bile produced in the gall bladder helps dissolve fats. However, it is difficult to break down saturated and trans fats, which may add to the stress on the gall bladder. Some major sources of these unhealthy fats are:-

- Processed meats and red meat
- Dairy products (do not include the low-fat ones)
- Processed and fried foods
- Candies, chocolates and ice cream

XIII. Some tips for fast recovery after Gall bladder removal

Removal of the gall bladder does not have any serious adverse effects on the body's digestive system. However, their systems will take time to adjust, during which they must make certain dietary changes to accommodate the body's condition. Some common tips include:-

- Eat smaller but frequent meals.
- Reduce the fat intake and consume low-fat alternatives.
- Avoid caffeine, spicy food and anything that might upset your digestive system.
- Consume easy-to-digest light meals.

Always be sure to consult your doctor in case you face nausea and pain.

Fig. 7 Refined Bread & Trans Fat banned in Gall Stone

A. Exercise

Getting regular physical exercise has been shown to have positive impact on the biliary tract. It can reduce cholesterol levels and help prevent gallstones from forming. The National Institute of Diabetes and Digestive and Kidney Diseases recommends at least 150 minutes of physical activity per week to prevent weight gain and improve your health. In addition, a 2021 study found that practicing yoga specifically can help with symptoms of gallbladder inflamation, especially in combination of practices of Unani medicine. Consult with your doctor before performing any strenuous activity. While exercise is helpful, some activities cause strain on your abdomen and may worsen your symptoms.

B. Dietary changes

Poor eating habits and consuming foods high in sugars and fats can contribute to gallbladder disease and gallstones. A diet with less fat and more fiber can help prevent gallstones and improve your health. Fried foods and other foods or condiments that contain fats even salad dressings are more difficult to break down and can cause pain. Increasing nutrient-rich foods in your diet, such as vegetables and fruits, can improve gallbladder function and help prevent complications. Some foods you should consider incorporating into your diet are:

- Dark, leafy greens
- Nuts
- Brown rice
- whole grains
- Fish
- Olive oil
- Beans
- Citrus fruits
- Low-fat dairy

Fig. 8 Yoga & Exercise Helpful in Gall Stone

C. Heated compress

Applying heat can be soothing and relieve pain. For gallbladder health, a heated compress can calm spasms and relieve pressure from bile buildup. To relieve gallbladder pain, wet a towel with warm water and apply it to the affected area for 15-20 minutes. You can also use a heating pad or hot water bottle for the same effect. Repeat this process until the pain goes away.

Just be careful not to place the hot surface directly on your skin, as you could burn yourself.

D. Magnesium

Research from 2018 has found an association between taking more magnesium and a lower chance of gallstones. This means magnesium deficiency can increase the chance of gallstone formation. To ease pain symptoms, mix a teaspoon of magnesium powder in warm water to drink every few hours. Magnesium is also available as an oral supplement. Discuss appropriate dosages with your doctor.

E. Dandelion (Taraxacum officinale L.)

Dandelion has been used as a natural remedy for various issues for centuries. A 2022 review of studies found that dandelion might have some anti-inflammatory properties that can help relieve the symptoms of various stomach problems, including gallstones. However, more research is necessary to confirm these findings, especially how dandelion might affect gallstone disease. A common way to consume dandelion is through tea. However, it's a good idea to speak with your doctor before trying it.

F. Lysimachiae herba

Lysimachiae herba is a herb commonly used in Chinese medicine. It has also been foundTrusted Source to contain antioxidants, which help fight free radicals in your body. Free radicals are compounds associated with a variety of diseases. Specifically, animal research has found it may help reduce the cholesterol content of bile, which can help reduce the chance of gallstones. However, more research on human subjects is needed to confirm this effect.

Conclusion

Cholelithiasis, which can be accompanied with or without notable symptoms. Gallstone disease is more commonly encountered in females, and quick and systematic diagnostic procedures, including history-

taking, physical examination, laboratory tests, and imaging tests, should be conducted properly to decide the management and prevent false positive events. Multiple gallstones requires surgical intervention, which is generally accomplished with laparoscopic cholecystectomy, which has fewer complications than open cholecystectomy.

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