Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 4, Issue 3 (2026)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

A Study Of Incidence Of Cholelithiasis And Associated Risk Factors In Females

Mujahid Rehman
Sarhad Institute of Allied Health Sciences, Sarhad University of Sciences and Information Technology, Peshawar

Syed Muhammad Shahsawar Jilani
Sarhad Institute of Allied Health Sciences, Sarhad University of Sciences and Information Technology, Peshawar

Salman Khan
Sarhad Institute of Allied Health Sciences, Sarhad University of Sciences and Information Technology, Peshawar

Akbar Ali* (Corresponding Author)
Sarhad Institute of Allied Health Sciences, Sarhad University of Sciences and Information Technology, Peshawar. Email: akbarali.siahs@suit.edu.pk

ABSTRACT

Cholelithiasis is a common digestive disorder affecting a significant proportion of the population, particularly women. Changes in lifestyle, diet, and hormonal factors have influenced its epidemiology over time.

To determine the progression of cholelithiasis in women and to analyze demographic characteristics, etiological factors, and clinical manifestations associated with the disease. This descriptive cross-sectional study included both symptomatic and asymptomatic female patients diagnosed with cholelithiasis. Diagnosis was confirmed using ultrasonography. A total of 110 participants were enrolled in the study.

The most commonly affected age group was 35–44 years. More than half of the patients (58.69%) had a body mass index (BMI) greater than 25. Abdominal discomfort was the most frequently reported symptom among all patients. Jaundice was present in 16 patients (14.13%). High HDL cholesterol levels were observed in 76.3% of patients. Mixed gallstones were the most commonly identified type. Use of contraceptives was reported by 58.09% of patients. Approximately 43.48% of patients consumed a vegetarian diet and demonstrated lower cholesterol levels. Cholelithiasis is commonly presents with abdominal discomfort and dyspepsia in women during their fourth and fifth decades of life. Laparoscopic cholecystectomy remains the preferred surgical treatment due to its lower risk profile and better outcomes.

Keywords— Cholelithiasis, Gallstones, Incidence, Demographic Factors.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 4, Issue 3 (2026)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Introduction

Gallstones, also known as cholelithiasis, are deposits of digestive fluid that have solidified and become trapped in the gallbladder. The gallbladder is an organ that looks like a pear and is situated directly beneath the liver in humans. The gallbladder is the organ that stores the digesting fluid known as bile, which is then delivered to the small intestine. These gallstones may eventually lead to problems such as cholecystitis, cholangitis, choledocholithiasis, gallstone pancreatitis, and very rarely cholangiocarcinoma. These consequences might occur as a result of further development of the gallstones (Kurzweil & Martin, 2018; Di Ciaula & Portincasa, 2018). Disease of the gallbladder is the most frequent reason for abdominal surgery and the gallbladder removal procedure is the second most common intra-abdominal surgery performed in western countries. Gall stones are responsible for more than 95% of biliary tract disease (Sattar et al., 2007). Globally, the prevalence of gall stone disease is increasing as a result of significant dietary changes, lifestyle adaptations brought on by a large intake of fast food, and an increase in sedentary behavior (Unisa et al., 2011).

1.2 Formation of gallstones

Gallstone production takes place through three primary pathways:

- Cholesterol supersaturation: Bile is accomplished of dissolving the liver's cholesterol excretion in most people. Cholesterol crystals may form if the liver creates more than the bile can dissolve. Crystals become stuck in the mucus of the gallbladder, resulting in gallbladder sludge. It is likely that the crystals may turn into stones, producing gallstone disease.
- Bilirubin: The breakdown of red blood cells in the liver releases bilirubin, which may develop in a person's circulation. Cirrhosis and liver damage could result from this. Through the breaking of hemoglobin, some hematological disorders lead the liver to produce excessive amounts of bilirubin. Gallstones may develop as a result of the elevated levels of bilirubin in the blood.
- Gallstones may occur if the gallbladder does not empty properly, which can be caused by hypo motility or reduced smooth muscle contraction (Yoo, 2018).

1.2 Bacteriology of Cholelithiasis

In about 30% of the patients with cholelithiasis, bacteria can be cultured either from the bile or from the wall of the gallbladder. An infection of the biliary tract may be caused by organisms of any type, includes gram-positive, gram-negative, and anaerobic organisms. The remaining six percent of bile tract infections are caused by anaerobic organisms. The vast majority of biliary tract infections are caused by aerobic species. Bacteria are often discovered in a gallbladder that is inflamed as well as in people who suffer from cholelithiasis, despite the fact that data shows normal bile is clean and safe. The permeability of an inflamed gallbladder is significantly changed, allowing bile acids to be absorbed and inorganic salts to be transported into the gallbladder lumen. Inflammation-induced changes in protein production and accumulation of extracellular

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

debris may have a role. Bacterial enzymes may modify the bile's chemical composition, resulting in a precipitate of bile salts due to changes in its solubility. Most gallstones are made up of a mixture of minerals. There are microorganisms even in the cleanest of stones (i.e. those whose structure consists more than 90 percent cholesterol). The exact etiology of gallstones is unknown. Brown pigment stones may change in chemical makeup after the infection process that caused them to develop is completed and eventually transform into mixed or almost pure cholesterol stones (Sattar et al., 2007).

1.3 Types of gallstones

Gallstones may be broadly categorized as cholesterol or pigment stones. Oversaturated bile in Europeans and Americans, which forms cholesterol crystals, indicates that the liver produces a large amount of cholesterol, which accounts for 80 to 90% of gallstones. In addition, pigment stones are more frequent in Asian and they can be classified as either high-residue, low-residue, or mixed pigment stones. There is a close correlation between these pigment stones and hemolysis, bacterial infection, or liver illness, as well as calcium bilirubinate and polymerized bilirubin production (Hundal & Shaffer, 2014). If gallstones become blocked in the gallbladder, they may cause acute cholecystic, even though some people don't experience any symptoms. If the causes of gallstone disease could be determined, further research might be done to stop its progression and its related complications (Febyan, 2020).

1.4 Epidemiology

It is estimated that 6% of men and 9% of women have cholelithiasis, making it a rather prevalent condition. Cholelithiasis is more common among Native American people. Africans and Asians are less likely than Europeans to suffer from gallstones. Gallstones might be caused by the increase in obesity. More than 80% of persons with gallstones are completely unaware they have them, despite their high prevalence. However, 1% to 2% of previously asymptomatic people may acquire biliary discomfort each year. Major problems (cholecystitis, choledocholithiasis, gallstone pancreatitis, and cholangitis) may arise in as little as 0.1 percent to 0.3 percent of patients who have already created to exhibit symptoms.

1.5 Clinical Manifestation and complications

The symptoms of cholelithiasis are often non-specific and irrelevant to the gallstones' existence. Some of the symptoms that can experienced include heartburn, acid regurgitation, belching, nausea, vomiting, bloating, stomach discomfort, chest pain, postprandial fullness or early
satiety, and flatulence. Other indications are postprandial fullness, and early satiety. When stones block the cystic or bile ducts, cholelithiasis may become complicated. Gallbladder discomfort is common when the cystic duct is temporarily blocked (before it dilates and the gallbladder delivers the stone to the gallbladder). Cholelithiasis is the medical term for this condition. When a huge stone is persistently stuck in the neck of the gallbladder, it causes acute cholecystitis, which may be fatal. A gallstone may pass through the cystic duct and get stuck and impacted in the common bile duct, resulting in blockage and jaundice. " A choledocholithiasis is the medical term for this problem.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 4, Issue 3 (2026)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

Acute gallstone pancreatitis may occur if gallstones travel via the cystic duct, common bile duct, and ampulla of the distal bile duct. This is due to the accumulation of fluid and increased pressure in the pancreatic ducts and the in-situ activation of pancreatic enzymes. A fistula between the gallbladder and small or large intestine may occur when big gallstones burst through the gallbladder wall, causing ileus or intestinal obstruction (Ibrahim et al., 2018).

1.6 Diagnosis

The diagnosis of cholelithiasis is made after examining a patient's medical history, doing a physical exam, analyzing the patient's blood, and ultrasonography.

1.7 Physical Examination

Abdominal palpation may reveal jaundice and pain in the right upper quadrant (RUQ). It's possible to have a favorable Murphy's sign too. There are times when the Charcot trio (fever, severe RUQ soreness, and jaundice) can observed in an emergency situation, which clearly suggests the existence of cholangitis and requires immediate treatment (Thomas, 2013).

1.8 Laboratory Tests

In order to diagnose cholelithiasis, many laboratory tests should be performed. While a normal white blood cell count (WBC) test may not automatically rule out a diagnosis, a complete blood count (CBC) may reveal an elevated white blood cell count (WBC). Other laboratory tests include the stool guaiac test, which is used to detect concealed or severe gastrointestinal bleeding, the liver function test, lipase, amylase, urinalysis, and pregnancy testing in women.

1.9 Imaging Tests

To provide early management and prevent complications with cholelithiasis, a reliable imaging technique is required (bacterial infection of the gallbladder, perforation, and other related conditions) false-positive imaging findings may save patients from unnecessary treatment. Among the efficient screening procedures are ultrasonography (USG), computed tomography (CT), and magnetic resonance cholangiopancreatography MRCP (Giljaca et al., 2015). Ultrasound is the primary and gold standard technology for diagnosing Cholelithiasis (Aslam et al., 2013).

1.10 Medicinal Treatment

Colicky pain is often treated with narcotic or nonsteroidal anti-inflammatory medicines (NSAIDs). Symptomatic therapy for nausea, vomiting, and fever may also be included in the treatment plan. The anti-spasmodic medication (hyoscine-N-butyl bromide) is used to calm and reduce the spasms of the gallbladder, which is another alternative for pain management. Comparison studies have indicated that NSAIDs are more effective as a pain reliever than nonsteroidal anti-inflammatory drugs (NSAIDs). The patient should abstain from eating as part of the conservative therapy of colicky pain and to avoid the synthesis of endogenous cholecystokinin (Henderson et al., 2002; Tazuma et al., 2017). According to EASL study, ursodeoxycholic acid (UDCA) is not indicated as

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

a precautionary therapy for gallstone disease in the general population. Otherwise, prophylactic UDCA (500 g/d) may help avoid stone development in people who have had post- bariatric post-bariatric surgery (Lammert et al., 2016). An RCT published in 2003 found that restrictive gastric bypass surgery significantly reduced the risk of gallstone formation within 24 months following the procedure (Gutt et al., 2020).

1.11 Surgical Treatment

Patients with minor biliary colic may be treated surgically, whereas those with problems can only be treated medically. Laparoscopic cholecystectomy may be used to treat the majority of individuals with symptomatic gallstones. There was no significant difference in complication rates or surgical time between the two procedures, but the shorter hospital stay (2.3 days; 95% CI, 2.3 to 3.9 days) and quicker recovery time noted in the Cochrane review of laparoscopic cholecystectomy indicated that the two procedures had similar outcomes (22 fewer days; 95 percent CI 8 to 37 days) (Keus et al., 2006). Open cholecystectomy is more likely in men, the elderly, prior upper abdominal surgery, a thicker gallbladder wall on ultrasound, and acute cholecystitis, among several other risk factors (Tayeb et al., 2005).

METHODOLOGY

Study Design

Descriptive cross-sectional study.

Study Settings

The study was done at Maqsood Medical Center (MMC) & General Hospital Peshawar, Pakistan.

Study Population

The cross-sectional study was conducted on the female patients of cholelithiasis at MMC General Hospital Peshawar, Pakistan.

Sampling Technique:

A suitable method of sampling was used. A complete history of each of the 110 patients was obtained, including data on age, sex, the type and severity of the symptoms, any previous experience with similar problems, dietary history, alcohol intake, and diabetes. Demographic data including name, age, address and marital status were also recorded.

Data Collection Procedure

The study was approved by the ethical review boards of a tertiary care hospital in Peshawar, Pakistan. Moreover, an informed consent is obtained from every respondent to this study. The data collection was pass out by means of pre-examined, pre-arranged and consistentquestionnaire to evaluate the incidence of cholelithiasis and related risk factors in females in MMC general hospital Peshawar, Pakistan. The questionnaire is clear enough to achieve the main objectives of the study. The questionnaire contains 20

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 4, Issue 3 (2026)

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

questions as 'yes' or 'no', multiple choice and socio demographic questions that were distributed among every respondent and together on the same or next day.

Data Analysis

The elements that followed the survey were investigated using a questionnaire, and the findings were collected very accurately. For the analysis of data graphical presentation on Microsoft Excel was used. In order to obtained percentage and incidence of cholelithiasis and associated risk factors the descriptive statistic was adopted for socio-demography and cross tabulation in socio-demography.

RESULTS

Age ranges were determined as follows: 25-35 years, 35-45 years, 45-55 years, and 55-65 years. As indicated in fig 1, the most common age group upon diagnosis was 35-45 years old. The mean age of females with high cholelithiasis incidence was 72.5, whereas the mean age of females with low cholelithiasis incidence was 7.5, with ages ranging from 25 to 35 years.

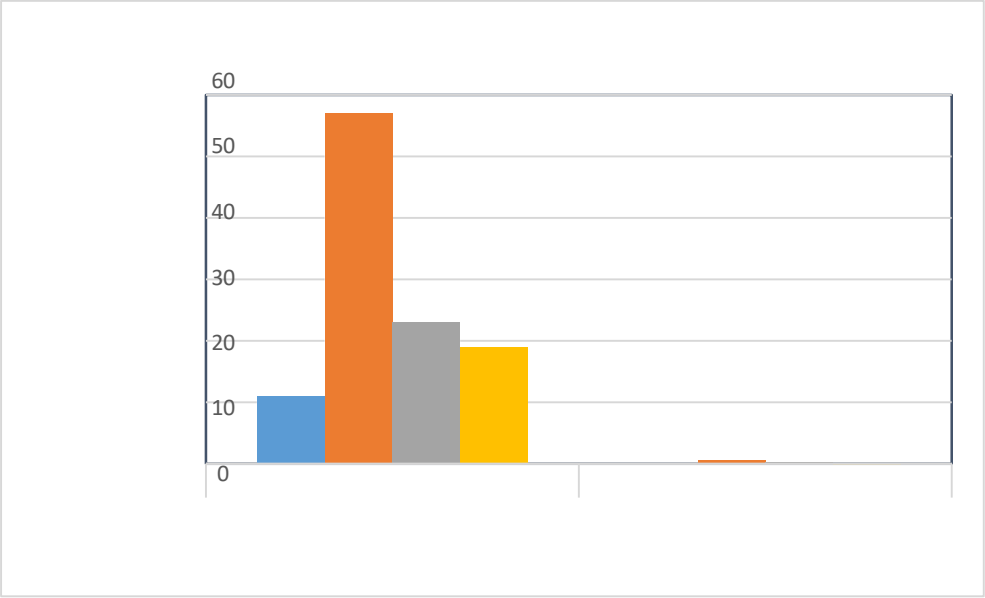

Fig 4.1: Demographic data for the samples

Pain in the abdomen was a common sign of cholelithiasis in all individuals (83.3 percent). 68 of these patients (73%) had chronic upper abdominal pain, while 24 of these patients (26%) had acute upper abdominal pain. Dyspepsia was seen in 61 individuals, followed by gastrointestinal symptoms such nausea and vomiting in 51 and 54 patients, respectively. There were 25 cases of fever and 16 cases of jaundice (22.7% and 22.7% respectively) (14.5 percent) as shown in table 1.

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 4, Issue 3 (2026)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Table 1: The clinical manifestations of cholelithiasis in affected people.

Clinical presentation	N	Percentage (%)
Abdominal pin	93	83%
Nausea	51	46%
Vomiting	54	49%
Fever	25	22%
Jaundice	16	14%
dyspepsia	6	55%

Sixty-eight patients (56.52 percent) ate a mixed diet that comprised both vegetarian and non-vegetarian foods, whereas forty-two patients (43.48 percent) ate just vegetarian foods. Vegetarians were somewhat older females who never smoked and drank alcohol on a regular basis. Diabetes and renal disease were less common among vegetarians. Vegetarians also reported reduced cholesterol level as shown in table 2.

Table 2: represent variables i.e. smoking, kidney disease and diet.

Variable	N (%)
Non-smoker	96 (87.27 %)
History of smoking or smoker	14 (12.27%)
Mixed diet	68 (56.52%)
Pure vegetarian diet	42 (43.48%)
Kidney disease	32 29%)

According to current study, in 110 cases of cholelithiasis, 37 (33%) patients were suffering from diabetes and about 79 females (71.8%) have no family history of gallstone. The presence of diabetes mellitus was not found to be associated with a significantly increased risk for the development of cholelithiasis. High HDL-cholesterol was observed among 84 cases (76.3%) while low HDL-cholesterol was reported in 26 (23%) patients.
Table 3: shows ratio of diabetes and cholesterol concentration for gallstone

Annual Methodological Archive Research Review
http://amresearchreview.com/index.php/Journal/about
Volume 4, Issue 3 (2026)

Online ISSN 3007-3197
Print ISSN 3007-3189

http://amresearchreview.com/index.php/Journal/about

Variable	N (%)
Diabetes mellitus	33%
HDL-cholesterol	76.3%
Low HDL-cholesterol	23%

According to existing research, 89.36% of the stones detected were mixed stones, 8.51% were cholesterol stones, and 2.13% were pigmented stones as shown in fig 2

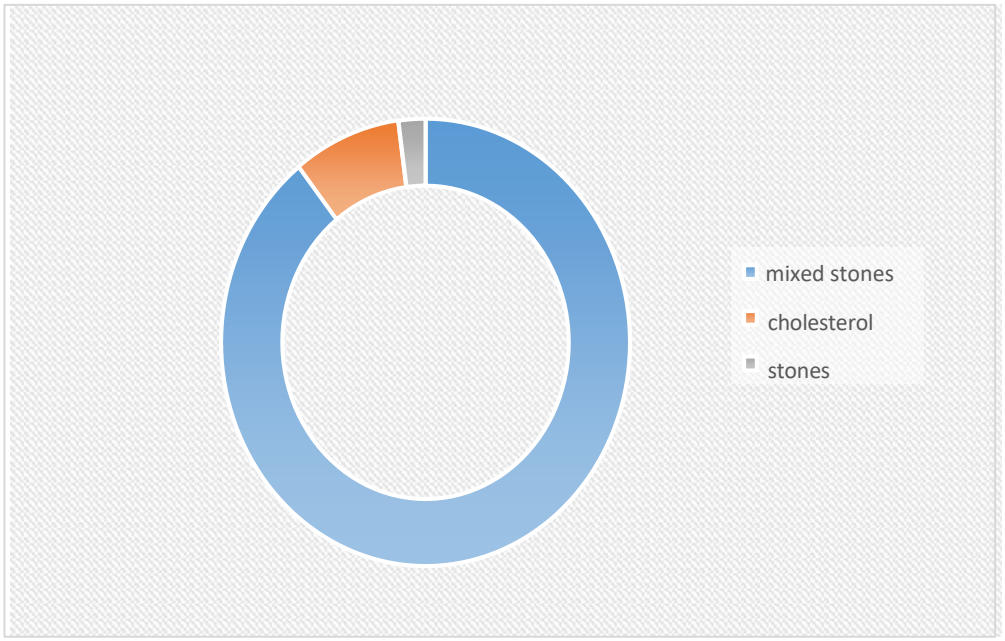

Fig 2: Type of stones analyzed in the study

DISCUSSION

In this study, high incidence of cholecystitis recorded at Maqsood Medical Center & General Hospital Peshawar, Pakistan which is very positive finding. Peak age incidence in our study was 35-45 years. The results were consistent with those of several other research, including a study performed in India's Gangetic River Basin, which came to similar conclusions (Unisa et al., 2011, HPB). The average age of women who had a high incidence of cholelithiasis was 72.5 years old, whereas the average age of women who had the fewest occurrences of cholelithiasis was 7.5 years old. The ages of the participants ranged from 25 to 35 years.

Online ISSN 3007-3197
Print ISSN 3007-3189

In the current research, 89 percent of the patients were female, which is comparable to the findings of Sharma et al., who found that females accounted for 78 percent of the total cases (Sharma et al., 1990, Journal of Clinical Gastroenterology). The results of our research with respect to age distribution, which are similarly comparable to the findings of Reddy BB et al, who observed a greater incidence of cholelithiasis among females and in females with a peak incidence during the third and fifth decades of life, are as follows: This may be due to variations in lifestyle modifications as well as eating pattern differences (Rachamalla et al., 2018, International Surgery Journal).

The current research found that discomfort in the right hypochondria was the most prevalent presenting symptom, followed by dyspepsia as the next most common symptom. These results were comparable to those that were discovered by Singh et al., who found that pain was the most prevalent symptom, followed by nausea, vomiting, and flatulence in their research (Singh et al., 2001, Journal of Gastroenterology and Hepatology). In contrast, Sharma et al research found dyspepsia to be the most prevalent presenting symptom, followed by discomfort, flatulence, and guarding as the most common indicator of presentation (Sharma et al., 1990, Journal of Clinical Gastroenterology). In our research, guarding was the symptom that presented itself to be the majority of the time, which is consistent with the findings of many other studies, as was discussed before.

As in recent findings, the incidence of gallstones was 56.53 percent in individuals eating a mixed diet and 42 percent in vegetarians; this shows that a higher consumption of protein with high-energy meals and saturated sugars with a lower intake of fiber are linked to an increased risk of gallstone development. The significance of orphan nuclear receptors in regulating fatty acid and hepatic cholesterol metabolism and excretion has recently been discovered, opening up new avenues for a better understanding of how dietary components affect the development of cholesterol gallstones (Di Ciaula et al., 2010, Gastroenterology Clinics).

There has been several research demonstrating that mixed stones (89.36 percent) were the most prominent type of gallstones, followed by cholesterol stones (8.51) and pigmented stones (2.13 percent). Earlier research by Chandran et al. also discovered a significant number of cholesterol gallstones (24%), as well as pigmented gallstones (13%), in combination with a high proportion of mixed gallstones. Furthermore, contrary to our results, Mohan et al in their investigations reported the highest proportion of cholesterol stones (87%), which may be related to dietary changes and other reasons (Mohan et al., 2005, Indian Journal of Surgery).

CONCLUSION

Cholelithiasis, typically referred to as gallstone disorder, is a substantial public health challenge. Population-based surveys help become aware of and higher recognize the risk factors associated with this circumstance, together with both modifiable and non-modifiable ones. This study ambitions to have a look at the superiority of scientific risk factors related to cholelithiasis among the general girl population. The prevalence of gallstones is anticipated to increase due to changes in environmental and lifestyle factors. The occurrence of the disorder rises with age and is more common in women. Right upper belly pain is identified as the primary symptom of gallstone disorder. Its

Online ISSN 3007-3197
Print ISSN 3007-3189

severity and frequency tend to progress via the distinctive stages of the circumstance. Advancing age and better frame mass index (BMI) are mounting threat elements, contributing to the transition from mild to extreme types of the sickness. A non-vegetarian (blended) food plan has additionally been related to an extra risk of gallstone formation as compared to a vegetarian diet. In regions in which cholelithiasis is commonplace, elements including woman gender, older age, and accelerated BMI play a chief role in its occurrence. Preventive applications must emphasize retaining a healthy BMI and promoting regular bodily activity, specifically amongst girls. Those measures should help reduce the chance of gallstone development. The findings of this study can also help physicians in making knowledgeable scientific selections. Further studies are suggested to explore the impact of these variables on the development of cholelithiasis. Gallstone disorder is maximum frequently found in both males and females during their fourth and fifth a long time of life. Many of the different types, combined stones are more accepted than LDL cholesterol or pigmented stones. Laparoscopic cholecystectomy remains the desired surgical remedy for each acute and chronic gallstone case.

References

Agunloye A, et al. Ultrasound prevalence of gallstone disease in diabetic patients.

Ahmed MH, Barakat S, Almobarak AO. The association between renal stone disease and cholesterol gallstones. *Renal Failure*. 2014;36(6):957–962.

Aslam HM, et al. Assessment of gallstone predictor: comparative analysis of ultrasonographic and biochemical parameters. *International Archives of Medicine*. 2013;6(1):1–7.

Bodmer M, et al. Statin use and risk of gallstone disease followed by cholecystectomy.

Chen CH, et al. Prevalence and risk factors of gallstone disease in an adult population of Taiwan. *Journal of Gastroenterology and Hepatology*. 2006;21(11):1737–1743.

Di Ciaula A, et al. Targets for current pharmacologic therapy in cholesterol gallstone disease. *Gastroenterology Clinics of North America*. 2010;39(2):245–264.

Di Ciaula A, Portincasa P. Recent advances in understanding and managing cholesterol gallstones. *F1000Research*. 2018;7:1529.

Febyan F. Cholelithiasis: a brief review on diagnostic approach and management in clinical practice. *International Journal of Medical Reviews*. 2020;7(3):98–101.

Giljaca V, et al. Endoscopic ultrasound versus magnetic resonance cholangiopancreatography for common bile duct stones. *Cochrane Database of Systematic Reviews*. 2015;(2):CD011549.

Gutt C, Schläfer S, Lammert F. The treatment of gallstone disease. *Deutsches Ärzteblatt International*. 2020;117(9):148–158.

Hazari MAH, Taskeen S, Arifuddin MS. Observational study on the prevalence of diabetes mellitus among ultrasonographically diagnosed cholelithiasis patients. *International Journal of Clinical and Experimental Physiology*. 2016.

Henderson SO, Swadron S, Newton E. Comparison of intravenous ketorolac and meperidine in the treatment of biliary colic. *The Journal of Emergency Medicine*. 2002;23(3):237–241.

Online ISSN 3007-3197
Print ISSN 3007-3189
http://amresearchreview.com/index.php/Journal/about

Hundal R, Shaffer EA. Gallbladder cancer: epidemiology and outcome. *Clinical Epidemiology*. 2014;6:99–109.

Ibrahim M, et al. Gallstones: watch and wait, or intervene. *Cleveland Clinic Journal of Medicine*. 2018;85(4):323–331.

JAMA. 2009;302(18):2001–2007.

Journal of Gastroenterology. 2017;52(3):276–300.

Keus F, et al. Laparoscopic versus open cholecystectomy for patients with symptomatic cholecystolithiasis. *Cochrane Database of Systematic Reviews*. 2006;(4):CD006231. Tayeb M, et al. Conversion from laparoscopic to open cholecystectomy: multivariate analysis of preoperative risk factors.*Journal of Postgraduate Medicine*. 2005;51(1):17–20.

Kurzweil A, Martin J. Transabdominal ultrasound. *Radiologic Clinics of North America*. 2018.

Lammert F, et al. EASL clinical practice guidelines on the prevention, diagnosis and treatment of gallstones. *Journal of Hepatology*. 2016;65(1):146–181.

Liu CM, et al. Clinical correlation of gallstone disease in a Chinese population in Taiwan. *World Journal of Gastroenterology*. 2006;12(8):1281–1286.

Mohan H, et al. Morphological spectrum of gallstone disease in 1100 cholecystectomies in North India. *Indian Journal of Surgery*. 2005;67(3):140–142.

Pacchioni M, et al. Association of obesity and type II diabetes mellitus as a risk factor for gallstones. *Digestive Diseases and Sciences*. 2000;45(10):2002–2006.

Rachamalla RR, Markapuram KK, Satish S. A one-year study of cholelithiasis at a tertiary care hospital of South India. *International Surgery Journal*. 2018;5(7):2444– 2448.

Ruhl CE, Everhart JE. Association of diabetes, serum insulin, and C-peptide with gallbladder disease. *Hepatology*. 2000;31(2):299–303.

Sattar I, et al. Frequency of infection in cholelithiasis. *Journal of the College of Physicians and Surgeons Pakistan*. 2007;17(1):48–50.

Sharma M, et al. Gallstone disease in north India: clinical and ultrasound profile in a referral hospital. *Journal of Clinical Gastroenterology*. 1990;12(5):547–549.

Singh V, et al. Epidemiology of gallstone disease in Chandigarh: a community-based study. *Journal of Gastroenterology and Hepatology*. 2001;16(5):560–563.

Stender S, Nordestgaard BG, Tybjærg-Hansen A. Elevated body mass index as a causal risk factor for symptomatic gallstone disease. *Hepatology*. 2013;58(6):2133–2141.

Tazuma S, et al. Evidence-based clinical practice guidelines for cholelithiasis 2016.

Thomas S. Differentiating abdominal pain using Murphy's sign. *Practice Nursing*. 2013;24(3):141–141.

Tsai CJ, et al. Glycemic load, glycemic index, and carbohydrate intake in relation to risk of cholecystectomy in women. *Gastroenterology*. 2005;129(1):105–112.

Unisa S, et al. Population-based study to estimate prevalence and determine risk factors of gallbladder diseases in the rural Gangetic basin of North India. *HPB*. 2011;13(2):117–125.

Yoo EH, Oh HJ, Lee SY. Gallstone analysis using Fourier transform infrared

Online ISSN 3007-3197
Print ISSN 3007-3189

spectroscopy (FT-IR). *Clinical Chemistry and Laboratory Medicine*. 2008;46(3):376– 381.

Yoo KS. Management of gallstone. *The Korean Journal of Gastroenterology*. 2018;71(5):253–259.