Original Research Article

CLINICAL PROFILE AND MANAGEMENT OUTCOMES OF GALLSTONE DISEASE IN A TERTIARY CARE CENTER

Vikram Purwar[1], Vijayant Kumar Sachan[1]

[1]*Assistant Professor, Department of General Surgery, Naraina Medical College & Research centre, Kanpur, Uttar Pradesh, India*

ABSTRACT

Background: Gallstone disease (GSD) is a prevalent gastrointestinal disorder influenced by multiple demographic, metabolic, and lifestyle factors. In India, increasing rates of obesity, diabetes, and changing dietary patterns have led to a rising burden of both uncomplicated and complicated gallstone presentations. This study aimed to evaluate the clinical profile, risk factors, diagnostic findings, and management outcomes of patients with gallstone disease in a tertiary care setting.

Materials and Methods: A prospective observational study was conducted among 114 patients diagnosed with gallstone disease at a tertiary care hospital. Data were collected on demographics, clinical features, imaging results, laboratory parameters, surgical management, and postoperative outcomes. Risk factor associations with complicated disease were analyzed using chi-square tests, with $p < 0.05$ considered statistically significant.

Results: The mean age of participants was 44.8 ± 13.6 years, with a female predominance (68.4%). Overweight and obesity (BMI ≥ 25 kg/m²) were noted in 71.8% of cases. Common presenting symptoms included right upper quadrant pain (86%), nausea (66.7%), and vomiting (45.6%). Complicated gallstone disease was identified in 14% of patients. Significant associations were observed between complications and age >45 years ($p = 0.008$), diabetes mellitus ($p = 0.001$), and parity ≥ 3 ($p = 0.038$). Elective laparoscopic cholecystectomy was the most common management modality (63.2%). Postoperative complication rates were low, with moderate–severe pain in 33.3%, wound infection in 6.1%, and no reported mortality.

Conclusion: Gallstone disease predominantly affects middle-aged, overweight females, with diabetes, older age, and multiparity significantly contributing to complications. Early surgical intervention, particularly laparoscopic cholecystectomy, remains safe and effective, even in selected complicated cases. Identifying high-risk patients is essential for timely management and preventing adverse outcomes.

Keywords: Gallstone disease, complications, risk factors, abdominal pain, BMI.

INTRODUCTION

Gallstone disease (GSD), medically termed cholelithiasis, refers to the formation of calculi within the gallbladder due to a disturbance in the balance of bile components such as cholesterol, bile salts, and bilirubin. It is a major public health concern globally, particularly in developing countries undergoing rapid dietary and lifestyle transitions. The prevalence of gallstone disease varies widely by geographic region, gender, ethnicity, and socioeconomic status. In Western countries, the prevalence is estimated to be around 10–15% of the adult population, with a lifetime risk of 20% in women and 10% in men by the age of 60.[1] In India, recent community-based studies report an overall prevalence ranging between 6–9%, with northern states reporting rates as high as 10–13%.[2]

Multiple risk factors contribute to gallstone formation, including age above 40 years, female sex, obesity, diabetes mellitus, rapid weight loss,

hyperlipidemia, and the use of oral contraceptives.[3] Women are two to three times more likely to develop gallstones than men, primarily due to the lithogenic effects of estrogen and progesterone on bile composition and gallbladder motility.[4] In India, changes in dietary patterns, increased consumption of refined carbohydrates and saturated fats, and a sedentary lifestyle have been associated with a rising incidence of gallstone disease, particularly in urban and semi-urban populations.[5]

Clinically, gallstone disease manifests along a spectrum ranging from asymptomatic incidental findings to symptomatic presentations such as biliary colic, chronic cholecystitis, acute cholecystitis, choledocholithiasis, and gallstone-induced pancreatitis. Asymptomatic gallstones are found in approximately 60–80% of affected individuals and may not require intervention.[6] However, symptomatic gallstones often necessitate prompt evaluation and management due to the risk of complications. Ultrasonography remains the first-line diagnostic tool due to its high sensitivity (95%) and specificity (96%) for detecting gallstones.[7] In cases of suspected choledocholithiasis or pancreatitis, further evaluation with magnetic resonance cholangiopancreatography (MRCP), endoscopic ultrasound (EUS), or endoscopic retrograde cholangiopancreatography (ERCP) may be warranted.[8]

Management of gallstone disease is guided by the clinical presentation. While asymptomatic patients are typically observed, those with recurrent biliary colic or complications require surgical intervention. Laparoscopic cholecystectomy is the standard of care, offering advantages such as reduced postoperative pain, shorter hospital stays, and faster recovery compared to open surgery.[9] In India, studies have shown that laparoscopic cholecystectomy is now widely adopted even in secondary-level hospitals, although conversion to open surgery may still be necessary in 5–10% of cases due to complications like dense adhesions or anatomical variations.[10]

Despite its high prevalence and potential complications, gallstone disease in India remains under-characterized in terms of regional clinical patterns, diagnostic practices, and treatment outcomes.[10] Therefore, this study aimed to evaluate the clinical profile, diagnostic modalities, and management strategies in patients presenting with gallstone disease at a tertiary care center. The findings are expected to provide context-specific insights that can help standardize management protocols and improve patient outcomes in similar settings.

MATERIALS AND METHODS

Study Design and Setting: This was a prospective observational study conducted in the Department of General Surgery at a tertiary care referral center located in North India. The study was carried out over a 24-months period, from January 2022 to December 2023. Institutional Ethics Committee approval was obtained prior to the initiation of the study.

Study Population: All adult patients aged 18 years and above who presented with symptoms suggestive of gallstone disease and were confirmed to have gallstones on abdominal ultrasonography were included in the study. Patients with a history of previous cholecystectomy, acalculous cholecystitis, gallbladder or hepatobiliary malignancy, pregnant women, and those unfit for surgery due to severe comorbid conditions were excluded. Informed written consent was obtained from all eligible participants.

Data Collection: For each participant, detailed demographic and clinical information was collected using a structured proforma. This included age, gender, body mass index (BMI), socioeconomic status, parity (for female patients), and comorbidities such as diabetes, hypertension, dyslipidemia, and hypothyroidism. Dietary patterns (vegetarian or non-vegetarian) and family history of gallstone disease were also noted. Presenting symptoms such as right upper quadrant pain, nausea, vomiting, jaundice, fever, or past similar episodes were documented along with physical examination findings including Murphy's sign and abdominal tenderness.

Clinical Evaluation and Investigations: All patients underwent baseline laboratory investigations including complete blood count (CBC), liver function tests (serum bilirubin, ALT, AST, ALP), renal function tests, fasting blood glucose, lipid profile, and serum amylase/lipase in suspected cases of pancreatitis. Abdominal ultrasonography was performed in all patients to confirm the presence, number, and size of gallstones, as well as to assess gallbladder wall thickening, pericholecystic fluid, and common bile duct (CBD) dilatation.

In patients with biochemical or clinical suspicion of choledocholithiasis or gallstone pancreatitis, magnetic resonance cholangiopancreatography (MRCP) was employed for further evaluation of the biliary system. Endoscopic retrograde cholangiopancreatography (ERCP) was used selectively for both diagnostic and therapeutic purposes, particularly in patients with retained CBD stones.

Management Strategy: Patients were categorized based on their clinical presentation. Asymptomatic patients were managed conservatively with dietary and lifestyle modification advice. Those with symptomatic but uncomplicated gallstone disease were scheduled for elective laparoscopic cholecystectomy. Patients presenting with complications such as acute cholecystitis, obstructive jaundice, or gallstone pancreatitis received initial conservative management including intravenous fluids, antibiotics, and analgesics, followed by interval cholecystectomy once stabilized.

Laparoscopic cholecystectomy was performed using the standard four-port technique by experienced surgeons. Conversion to open cholecystectomy was

undertaken when required due to intraoperative difficulties such as dense adhesions, bleeding, or anatomical uncertainty. Indications for conversion and intraoperative complications were clearly documented.

In patients with choledocholithiasis, ERCP with sphincterotomy and stone extraction was performed either before or after cholecystectomy based on individual clinical circumstances and institutional protocol.

Outcome Measures: Primary outcomes included the pattern of clinical presentation, types of diagnostic investigations used, nature and timing of surgical intervention, intraoperative findings, operative time, rate and reasons for conversion to open cholecystectomy, postoperative complications, and length of hospital stay. Postoperative follow-up was done for a minimum of 30 days to monitor for complications such as wound infection, bile leak, or recurrent symptoms.

Statistical Analysis: All collected data were entered into Microsoft Excel and analyzed using SPSS version 20.0. Continuous variables were presented as mean ± standard deviation, and categorical variables as frequencies and percentages. Chi-square test was applied to examine associations between categorical variables. A p-value of less than 0.05 was considered statistically significant.

RESULTS

The mean age of the study participants was 44.8 ± 13.6 years, with the majority aged between 31–45 years (35.1%), followed by 46–60 years (27.2%). Females predominated (68.4%) over males (31.6%). Most patients were overweight or obese, with 42.9% having a BMI of 25–29.9 kg/m² and 28.9% ≥30 kg/m². A higher proportion resided in urban areas (60.5%), and the majority belonged to the lower middle (43.0%) or upper middle (36.0%) socioeconomic classes. Among 78 female patients, 46.2% were multiparous (parity >3). A family history of gallstone disease was noted in 21.1% of cases, and 21.9% had diabetes mellitus. Non-vegetarian dietary habits were prevalent (75.4%). Symptom duration exceeded 4 weeks in 45.6% of patients, while 38.6% had symptoms for 1–4 weeks and 15.8% reported symptoms of less than a week [Table 1].

Table 1: Baseline Characteristics of Study Participants (n = 114).

Variables	Frequency (%)/Mean ± SD
Age (years)	44.8 ± 13.6
Age group	
18–30 years	22 (19.3%)
31–45 years	40 (35.1%)
46–60 years	31 (27.2%)
>60 years	21 (18.4%)
Gender	
Male	36 (31.6%)
Female	78 (68.4%)
Body Mass Index category (Kg/m2)	
<18.5	5 (4.4%)
18.5–24.9	27 (23.8%)
25–29.9	49 (42.9%)
≥30.0	33 (28.9%)
Residence	
Urban	69 (60.5%)
Rural	45 (39.5%)
Socioeconomic status	
Upper	8 (7.0%)
Upper Middle	41 (36.0%)
Lower Middle	49 (43.0%)
Lower	16 (14.0%)
Parity (n = 78)	
Nulliparous	14 (17.9%)
1 to 2	32 (35.9%)
>3	36 (46.2%)
Family history of Gall Stone Disease	24 (21.1%)
History of Diabetes Mellitus	25 (21.9%)
Diet	
Veg	28 (24.6%)
Non-Veg	86 (75.4%)
Duration of symptoms*	
<1 week	18 (15.8%)
1–4 weeks	44 (38.6%)
>4 weeks	52 (45.6%)

* 9 days (Range: 2–60 days)

Right upper quadrant (RUQ) pain was the most common presenting symptom, observed in 86% of patients, followed by nausea (66.7%), vomiting (45.6%), dyspepsia (39.5%), and fever (29.8%).

Jaundice and shoulder/back radiation were reported in 19.3% and 23.7% of cases, respectively, while Murphy's sign was elicited in 36.8%. Ultrasonography confirmed gallstones in all patients (100%), with gallbladder wall thickening noted in 30.7%. Among those who underwent MRCP (n=24), dilated CBD was seen in 75% and CBD stones in 58.3%. ERCP (n=16) led to CBD clearance in 87.5% and sphincterotomy in 81.3%. CT abdomen (n=9) revealed pancreatitis in 44.4% and perforation in 22.2%. Biochemical abnormalities included elevated total bilirubin in 23.7%, ALP in 28.9%, and amylase/lipase in 10.5% of patients [Table 2].

Table 2: Clinical Presentation and Investigative Findings of Study Participants.

Parameters	Frequency (%)
Symptom/Sign	
Right upper quadrant (RUQ) pain	98 (86.0%)
Nausea	76 (66.7%)
Vomiting	52 (45.6%)
Fever	34 (29.8%)
Jaundice	22 (19.3%)
Dyspepsia	45 (39.5%)
Shoulder/back radiation	27 (23.7%)
Murphy's sign	42 (36.8%)
Investigations	
Ultrasonography (USG)	
Gallstones	114 (100%)
Wall thickening	35 (30.7%)
MRCP (n = 24)	
CBD stones	14 (58.3%)
Dilated CBD	18 (75.0%)
ERCP (n = 16)	
CBD clearance	14 (87.5%)
Sphincterotomy	13 (81.3%)
CT Abdomen (n = 9)	
Perforation	2 (22.2%)
Pancreatitis	4 (44.4%)
Total bilirubin >1.2 mg/dL	27 (23.7%)
ALP >150 IU/L	33 (28.9%)
Raised amylase/lipase	12 (10.5%)

Elective laparoscopic cholecystectomy was the most common management approach, performed in 63.2% of patients, followed by emergency laparoscopic surgery in 14% and interval cholecystectomy in 10.5%. Conservative management was opted for 12.3% of patients, while 14% underwent ERCP with stone extraction. Conversion to open cholecystectomy occurred in 5.3% of cases, and 3.5% underwent primary open procedures. The mean operative time was 58.2 ± 12.6 minutes. Postoperatively, 33.3% experienced moderate to severe pain within the first 48 hours. Wound infections were seen in 6.1%, bile leak in 1.8%, and ileus lasting more than 48 hours in 2.6%. The 30-day readmission rate was 4.4%, with no reported mortality. The average hospital stay was 3.2 ± 1.4 days [Table 3].

Table 3: Management Modalities and Postoperative Outcomes of Study Participants.

Variable	Frequency (%)/Mean ± SD
Management Category	
Conservative management	14 (12.3%)
Elective laparoscopic cholecystectomy	72 (63.2%)
Emergency laparoscopic surgery	16 (14.0%)
Interval cholecystectomy	12 (10.5%)
ERCP + stone extraction	16 (14.0%)
Conversion to open cholecystectomy	6 (5.3%)
Primary open cholecystectomy	4 (3.5%)
Mean operative time (min)	58.2 ± 12.6
Outcome/Complication	
Moderate–severe pain (VAS ≥5) 1st 48 hours	38 (33.3%)
Wound infection	7 (6.1%)
Bile leak	2 (1.8%)
Ileus >48 hrs	3 (2.6%)
Readmission (30-day)	5 (4.4%)
Length of stay (days)	3.2 ± 1.4
Mortality	0 (0%)

Among the 114 patients, 16 (14.0%) had complicated gallstone disease. Complicated cases were significantly more common in patients aged >45 years (75.0% vs. 40.8%, p = 0.008), those with

diabetes mellitus (56.3% vs. 18.4%, p = 0.001), and women with parity ≥3 (71.4% vs. 38.2%, p = 0.038). Although higher BMI (≥25 kg/m²) and non-vegetarian diet were more prevalent in the complicated group (87.5% and 87.5%, respectively),

these differences were not statistically significant. Similarly, female gender and family history of gallstone disease showed no significant association with complication status [Table 4].

Table 4: Association of Risk Factors with Type of Gallstone Disease (n = 114).

Risk Factor	Uncomplicated (n = 98)	Complicated (n = 16)	p-value
Age > 45 years	40 (40.8%)	12 (75.0%)	0.008
Female gender	66 (67.3%)	12 (75.0%)	0.542
BMI ≥ 25 kg/m²	68 (69.4%)	14 (87.5%)	0.132
Diabetes mellitus	18 (18.4%)	9 (56.3%)	0.001
Parity ≥3*	26 (38.2%)	10 (71.4%)	0.038
Non-vegetarian diet	72 (73.5%)	14 (87.5%)	0.221
Family history of GSD	19 (19.4%)	5 (31.3%)	0.302

*(n = 78)

DISCUSSION

Gallstone disease (GSD) continues to be a significant cause of morbidity in both developed and developing nations, with a rising trend attributed to changes in lifestyle, dietary patterns, and comorbid conditions such as obesity and diabetes. In the present study of 114 patients, the mean age was 44.8 ± 13.6 years, and the majority were female (68.4%), consistent with the global epidemiology where gallstones are more prevalent in women due to hormonal influences such as estrogen and progesterone, which promote cholesterol supersaturation in bile and impair gallbladder motility.[11,12] This female predominance is similar to findings by Saxena et al., and Rachamalla et al., who reported female proportions of 63–70% in North and South India.[13,14]

A high percentage of our patients (71.8%) were either overweight or obese (BMI ≥25 kg/m²), reaffirming obesity as a strong risk factor for gallstone formation. Obesity increases hepatic secretion of cholesterol, which contributes to bile supersaturation and nucleation of cholesterol crystals.[15] Comparable prevalence of overweight/obese patients was reported by Hendarto et al., and Wang et al.[16,17] Urban residence and middle socioeconomic status were dominant in our cohort, likely reflecting both lifestyle factors (such as high-fat, low-fiber diets) and healthcare-seeking behavior. Notably, 75.4% of participants consumed non-vegetarian diets, a known risk factor for gallstone disease due to higher intake of cholesterol and saturated fats.[18]

Clinically, the most frequent symptom was right upper quadrant (RUQ) pain, observed in 86% of patients, followed by nausea (66.7%) and vomiting (45.6%). These findings are consistent with classical presentations of biliary colic, as described in studies by Lodha et al. and Kumar et al., who reported RUQ pain in over 80% of symptomatic cases.[19,20] Dyspepsia, shoulder/back radiation, and Murphy's sign were less commonly reported but remain important clinical indicators, particularly in differentiating uncomplicated from complicated cholelithiasis. The duration of symptoms was over 4 weeks in nearly half of the patients, indicating either delayed presentation or misattribution to non-biliary

dyspepsia—an issue also noted in Indian primary care settings by Nayak et al.[21]

Radiologically, ultrasonography confirmed gallstones in 100% of patients, with gallbladder wall thickening in 30.7%, suggesting inflammation. MRCP and ERCP were used selectively in suspected choledocholithiasis cases, with MRCP revealing dilated CBD in 75% and CBD stones in 58.3% of those scanned. ERCP led to successful CBD clearance in 87.5%, mirroring clearance rates reported by Sajjan et al. and Bagdai et al. (85–90%).[22,23] CT abdomen was reserved for complex cases, revealing pancreatitis and perforation in a small subset, again consistent with its role in detecting complications beyond the capacity of ultrasound.

From a therapeutic standpoint, the majority of patients (63.2%) underwent elective laparoscopic cholecystectomy, which remains the preferred modality for symptomatic gallstones. Emergency surgery was required in 14% of cases, and 10.5% underwent interval cholecystectomy after stabilization. Our conversion rate to open cholecystectomy was low (5.3%), indicating good laparoscopic access even in complicated cases. These figures align with Indian studies by Nassar et al., and Shah et al., who reported conversion rates of 4–7% in tertiary settings.[24,25] The mean operative time was 58.2 ± 12.6 minutes, within the expected range for laparoscopic procedures.

Postoperative outcomes were generally favorable, with moderate-to-severe pain in 33.3% during the first 48 hours, wound infection in 6.1%, and bile leak in only 1.8% of cases. The 30-day readmission rate was 4.4%, and no mortality was recorded. These outcomes are reassuring and consistent with studies by Veerabhadrappa et al., and Pahari et al., reported wound infection rates of 5–8% and bile leak rates below 2% in elective laparoscopic cohorts.[26,27] The average hospital stay of 3.2 ± 1.4 days also reflects minimally invasive recovery and early discharge protocols.

Importantly, 16 patients (14.0%) presented with complicated gallstone disease (e.g., acute cholecystitis, pancreatitis, cholangitis), and their profiles were statistically distinct from

uncomplicated cases. Age >45 years (75.0% vs. 40.8%, p = 0.008), diabetes mellitus (56.3% vs. 18.4%, p = 0.001), and high parity (71.4% vs. 38.2%, p = 0.038) were significantly associated with complications. These associations are consistent with reports by Matsui et al. and Ratheesh et al., who identified advancing age and diabetes as predictors of severe disease progression and poorer surgical outcomes.[28,29] Diabetes, in particular, predisposes to silent infections, poor immune response, and gallbladder dysmotility, all contributing to complicated presentations.[30]

Although obesity (BMI ≥25) and non-vegetarian diet were more common among complicated cases (87.5% each), they did not reach statistical significance, suggesting that while these are risk factors for gallstone formation, they may not independently drive complications. Family history of GSD also showed a higher trend in complicated cases (31.3% vs. 19.4%) but without statistical significance. This may be due to the sample size or genetic heterogeneity in gallstone pathogenesis, as supported by inconsistent findings in previous genetic epidemiological studies.[31]

CONCLUSION

This study reaffirms the multifactorial nature of gallstone disease, where modifiable risk factors like obesity, diet, and diabetes intersect with demographic and reproductive variables to influence disease progression. Early identification of high-risk patients—especially older, diabetic, and multiparous women—can aid in timely surgical intervention and complication avoidance. The findings also support the safety and efficacy of laparoscopic surgery even in selected complicated cases, provided appropriate preoperative optimization is ensured.

REFERENCES

1. Pak M, Lindseth G. Risk Factors for Cholelithiasis. Gastroenterol Nurs. 2016;39(4):297-309.
2. Schiappacasse G, Soffia P, Silva C, Villacrés F. Computed tomography imaging of complications of acute cholecystitis. Indian J Radiol Imaging. 2018;28(2):195-199.
3. Baddam A, Akuma O, Raj R, et al. Analysis of Risk Factors for Cholelithiasis: A Single-Center Retrospective Study. Cureus. 2023;15(9):e46155.
4. Wang HH, Liu M, Clegg DJ, Portincasa P, Wang DQ. New insights into the molecular mechanisms underlying effects of estrogen on cholesterol gallstone formation. Biochim Biophys Acta. 2009;1791(11):1037-1047.
5. Arvind K, Kalghatgi S, Kulkari M, Vipin T, Kamat V. Study to identify dietary factors and life style patterns responsible for gall stones among north Karnataka patients. Int J surg Orthopedics. 2017;3(3):76-81.
6. Lee BJH, Yap QV, Low JK, Chan YH, Shelat VG. Cholecystectomy for asymptomatic gallstones: Markov decision tree analysis. World J Clin Cases. 2022;10(29):10399-10412.
7. Pisano M, Allievi N, Gurusamy K, et al. 2020 World Society of Emergency Surgery updated guidelines for the diagnosis and treatment of acute calculus cholecystitis. World J Emerg Surg. 2020;15(1):61.
8. De Castro VL, Moura EG, Chaves DM, Bernardo WM, Matuguma SE, Artifon EL. Endoscopic ultrasound versus magnetic resonance cholangiopancreatography in suspected choledocholithiasis: A systematic review. Endosc Ultrasound. 2016;5(2):118-128.
9. Alius C, Serban D, Bratu DG, et al. When Critical View of Safety Fails: A Practical Perspective on Difficult Laparoscopic Cholecystectomy. Medicina (Kaunas). 2023;59(8):1491.
10. Virk S, Arora H, Patil P, et al. An Indian surgeon's perspective on management of asymptomatic gallstones. Asian J Endosc Surg. 2024;17(2):e13297.
11. Sun H, Warren J, Yip J, et al. Factors Influencing Gallstone Formation: A Review of the Literature. Biomolecules. 2022;12(4):550.
12. Gu LG, Zheng YM, Xu C, et al. [Analysis of the pathogenesis and risk factors of gallstone]. Zhonghua Wai Ke Za Zhi. 2023;61(5):389-394.
13. Saxena PK, Golandaj VK, Malviya VK. Epidemiological study in operated patients with cholelithiasis and analysis of risk factors. Surgical Update: Int J Surg Orthopedics. 2019;5(5):340-345.
14. Rachamalla RR, Markapuram KK, Satish S. A one-year study of cholelithiasis at a tertiary care hospital of South India. Int Surg J. 2018;5(7):2444-2448.
15. Parra-Landazury NM, Cordova-Gallardo J, Méndez-Sánchez N. Obesity and Gallstones. Visc Med. 2021;37(5):394-402.
16. Hendarto H, Akbar FN, Muzakki JB, Amri RA, Nugraha SNA, Adlani H. Obesity, dyslipidemia, and diabetes mellitus as risk factors in cholelithiasis. Electron J Gen Med. 2023;20(6):em549.
17. Wang K, Liu Z, Tang R, et al. Gallstones in the Era of Metabolic Syndrome: Pathophysiology, Risk Prediction, and Management. Cureus. 2025;17(3):e80541.
18. Di Ciaula A, Garruti G, Frühbeck G, et al. The Role of Diet in the Pathogenesis of Cholesterol Gallstones. Curr Med Chem. 2019;26(19):3620-3638.
19. Lodha M, Chauhan AS, Puranik A, et al. Clinical Profile and Evaluation of Outcomes of Symptomatic Gallstone Disease in the Senior Citizen Population. Cureus. 2022;14(8):e28492.
20. Kumar SB, Reddy V, Reddy SV, Mohan RC, Koneru J. A study of clinical presentations and management of cholelithiasis. Int Surg J. 2019;6:2164-2167.
21. Nayak J, Prusty N, Rajsamant NK, Panda S, Sahu BK. Clinical Profiling of Cholelithiasis Patients at a Tertiary Care Facility: A Cross-Sectional Study. Int J Pharm Clin Res 2023;15(12);315-318.
22. Sajjan SC, Javali S, Madhusudhan BV, Ramya B. Clinical profile of patients with cholelithiasis at a tertiary care hospital. Int J Surg Sci. 2021;5(2): 244-246.
23. Bagdai AK, Sutaria A. A Clinical Study Of Cholelithiasis Presentation And Management In Tertiary Care Hospital: A Clinical Study Of Cholelithiasis Presentation And Management. Natl J Integr Res Med. 2020;11(2):17-20.
24. Nassar AHM, Zanati HE, Ng HJ, Khan KS, Wood C. Open conversion in laparoscopic cholecystectomy and bile duct exploration: subspecialisation safely reduces the conversion rates. Surg Endosc. 2022;36(1):550-558.
25. Shah J, Choksi D, Damor S, Bharadava P. Conversion Rate of Laparoscopic to Open Cholecystectomy: A Prospective Study. Int J Current Medical Applied Sci. 2016;11(3):133-137.
26. Veerabhadrappa SV, Tank P, Singh A, Goel S, Nathwani P. A study of gall stone disease from a tertiary care center of Madhya Pradesh, India. Int Surg J. 2017;4(2):728-731.
27. Pahari S, Basukala S, Piya U, et al. Gallstone among Patients Presenting to the Department of Surgery in a Tertiary Care Center: A Descriptive Cross-sectional Study. JNMA J Nepal Med Assoc. 2023;61(260):315-319.
28. Matsui Y, Hirooka S, Yamaki S, et al. Assessment of clinical outcome of cholecystectomy according to age in preparation for the "Silver Tsunami". Am J Surg. 2019;218(3):567-570.
29. Ratheesh R, Ulrich MT, Ghozy S, Al-Jaboori M, Nayak SS. The association between diabetes and gallstones: a nationwide population-based cohort study. Prz Gastroenterol. 2023;18(3):292-299.
30. Ali S, Ahamad ST, Talpur AS, Parajuli S, Farooq J. Prevalence of Non-insulin-dependent Diabetes Mellitus Among Patients with Cholelithiasis: A Single-centered, Cross-sectional Study. Cureus. 2018;10(4):e2444.
31. Pęczuła A, Czaplicki A, Przybyłkowski A. Genetics of Gallstones. Genes (Basel). 2025;16(3):256.