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Original Research Article

Frequency of Diabetes Mellitus among the Gallstones Patients: An Observational Study

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Abstract: ***Background:*** Gallstone disease (GSD) and diabetes mellitus (DM) are common disorders that often coexist due to overlapping metabolic risk factors, including obesity, insulin resistance, and dyslipidemia. The coexistence of these conditions contributes to increased risk of complications and poorer clinical outcomes. This study aimed to determine the frequency of diabetes mellitus among patients diagnosed with gallstones at private hospital, providing insight into the metabolic burden in this population. ***Methods:*** An observational study was conducted from March 2021 to October 2021 involving 51 adult patients diagnosed with gallstones via abdominal ultrasonography. Patients with pregnancy, or under 18 years were excluded. Data on demographics, clinical history, fasting plasma glucose, and glycated hemoglobin (HbA1c) were collected through structured interviews and laboratory testing. Diagnosis of DM followed American Diabetes Association criteria. Anthropometric measurements, including body mass index (BMI) and waist-to-hip ratio (WHR), were recorded using standardized procedures. Data were analyzed using SPSS version 23.0, employing descriptive statistics to estimate prevalence and characterize clinical features ***Results*:** A total of 51 cholelithiasis patients were included, with a mean age of 43.0 ± 12.0 years; 53% were female. Overweight and obesity were prevalent in 47% and 18% of patients, respectively. Diabetes mellitus was present in 37.3% of cases, more common among females. Based on fasting glucose levels, 35.3% had overt diabetes, 21.6% had pre-diabetes, and 43.1% had normal levels. HbA1c analysis revealed 35.3% had uncontrolled or poorly controlled diabetes. These findings highlight a notable burden of diabetes and metabolic risk factors among gallstone patients. ***Conclusion:*** The study demonstrates a notable frequency of diabetes mellitus among patients with gallstones, emphasizing the need for routine diabetes screening and integrated management to reduce complications and improve outcomes in this population.

Keywords: Diabetes Meletus, Gallstones, chronic metabolic disorder, frequency.

INTRODUCTION

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by persistent hyperglycemia, resulting in progressive damage to multiple organs and tissues. Globally, DM represents a major public health challenge, affecting an estimated 382 million individuals in 2013, with projections rising to 592 million by 2035 [1]. Type 2 diabetes mellitus (T2DM), primarily caused by insulin resistance, accounts for approximately 85% of all diabetes cases, while type 1 diabetes mellitus (T1DM) stems from insulin deficiency [1]. The substantial burden of DM is compounded by its severe complications, including nephropathy, neuropathy, retinopathy, peripheral vascular disease, and ischemic heart disease, highlighting the critical need to investigate its associated comorbidities [1].

Gallstone disease (GSD) is another prevalent condition affecting 10–15% of adults in developed countries and 7–10% of the global population with symptomatic or asymptomatic cholelithiasis [2,3]. Gallstones, predominantly cholesterol crystals, form due to bile supersaturation, nucleation of cholesterol crystals, impaired gallbladder emptying, and altered intestinal motility [2]. GSD can result in serious complications such as acute pancreatitis, cholecystitis, obstructive

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jaundice, and cholangitis, with mortality rates up to 20% in severe cases [4,5]. Ultrasonography remains the diagnostic gold standard, demonstrating sensitivity of 90–96% [2,6].

Emerging evidence indicates a strong association between DM and increased risk of gallstone formation. Metabolic abnormalities commonly seen in diabetes such as obesity, insulin resistance, hyperinsulinemia, dyslipidemia, and certain dietary patterns contribute to biliary stasis and impaired gallbladder motility, fostering lithogenesis [7-10]. Additionally, autonomic neuropathy prevalent in diabetics may further impair gallbladder emptying, increasing gallstone risk [11]. While some epidemiological studies report gallstone prevalence as high as 36.2% among diabetic populations, results vary, and the relationship is recognized as multifactorial and complex [12,13].

Clinically, diabetic patients undergoing cholecystectomy for GSD experience higher morbidity and mortality rates compared to non-diabetics. Morbidity in diabetics has been reported to be over twice that of non-diabetics, with infections occurring threefold more frequently [14,15]. This heightened vulnerability is attributed to diabetes-induced immunosuppression driven by hyperglycemia, dehydration, malnutrition, vascular complications, and impaired neutrophil function [16].

Other established risk factors for gallstone formation include advanced age, female sex, multiparity, hormone replacement therapy, oral contraceptive use, hypertriglyceridemia, genetic predisposition, certain medications, terminal ileal resection, gallbladder hypomotility, and total parenteral nutrition [2, 17,18].

Despite the significant health burden of DM and GSD in South Asia, particularly Pakistan where DM prevalence is approximately 11.77% [19], there remains a paucity of region-specific data examining their coexistence. This study was conducted at private hospital, Dhaka, Bangladesh to assess the frequency of diabetes mellitus among patients diagnosed with gallstones, thereby contributing valuable regional insight into this important clinical association and informing future healthcare strategies.

METHODOLOGY

An observational study was conducted at private hospital, Dhaka, Bangladesh, over an eight-months period from March 2021 to October 2021. The study population included 51 adult patients of both sexes who were diagnosed with gallstones by abdominal ultrasonography during the study period. Patients with a previous history of cholecystectomy, pregnant women, and patients under the age of 18 were excluded from the study.

A structured, interview-based questionnaire was developed by the authors to collect demographic data, clinical history, and risk factors associated with gallstones and diabetes. Informed written consent was obtained from all participants prior to data collection.

Diagnosis of diabetes mellitus was established according to the American Diabetes Association guidelines, either by documented medical history or by performing fasting plasma glucose and HbA1c testing during the study (American Diabetes Association, 2023) [20]. Anthropometric measurements were taken using standardized procedures: height was measured with a non-stretchable measuring tape against a flat wall, body weight was recorded using a calibrated weighing machine, and body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Waist circumference was measured at the umbilical level with the participant standing, and hip circumference was measured at the widest point over the buttocks. Waist-to-hip ratio (WHR) was calculated by dividing waist circumference by hip circumference. Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 23.0 (IBM Corp., Armonk, NY). Descriptive statistics, including frequency and percentage, were used to present the frequency of diabetes among gallstone patients and other relevant variables. Confidentiality of participant information was maintained throughout the study. Participants were informed of the estimated duration of the interview and their voluntary participation was emphasized. Interviews were not recorded, and no compensation was provided.

RESULTS

Table 1: Demographic and Clinical Characteristics of the Study Population (n=51)

Variable	n (%)
Age	Mean (SD): 43 ± 12.0
Gender	
Female	27 (53%)
Male	24 (47%)
BMI	
<18.5	2 (4%)
18.5–23	16 (32%)
23.1–27.5	24 (47%)
>27.5	9 (18%)

Table 1 presents the demographic and clinical characteristics of the study population (n = 51). The mean age was 43.0 ± 12.0 years. Females accounted for 53% (n = 27) and males 47% (n = 24). BMI categories included 4% (n = 2) underweight (<18.5), 32% (n = 16) normal weight (18.5–23), 47% (n = 24) overweight (23.1–27.5), and 18% (n = 9) obese (>27.5). **(Table 1)**

Figure 1: Frequency of Diabetes Mellitus (DM) among Cholelithiasis Patients by Gender

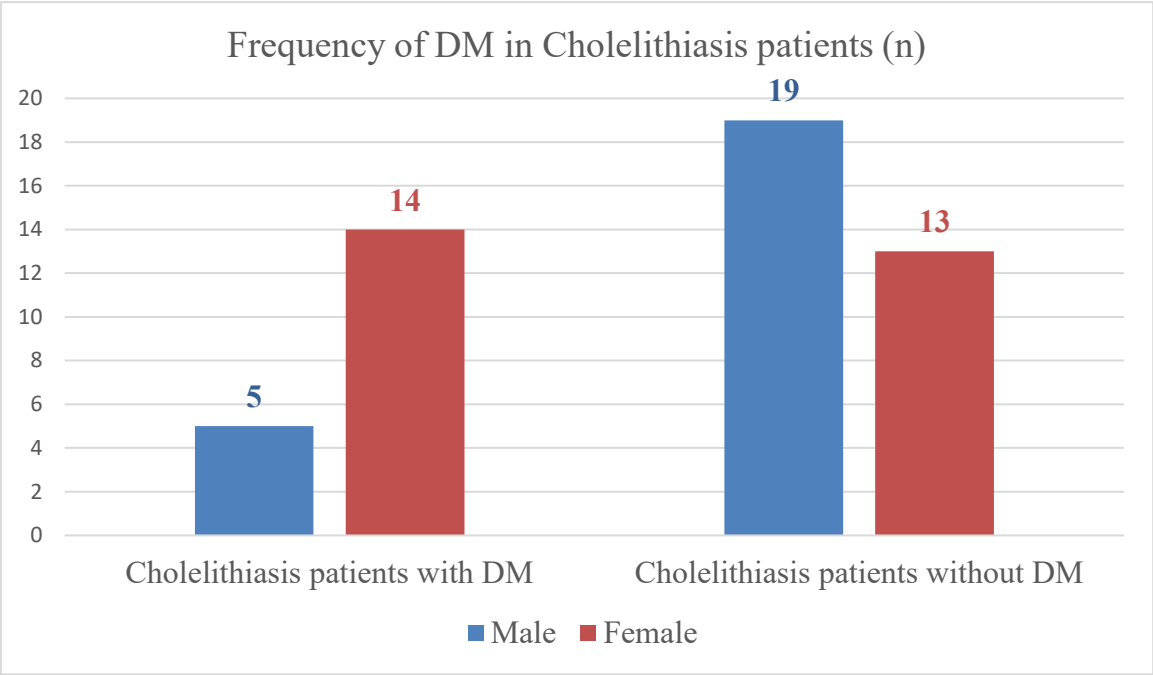

Figure 1 illustrates the distribution of diabetes mellitus (DM) among cholelithiasis patients by gender. Among patients with DM, 14 were female and 5 were male. In contrast, among patients without DM2, 13 were female and 19 were male. **(Figure 1)**

Table 2: Distribution of Male and Female Cholelithiasis Patients Across Different Age Groups (n = 51)

Age Group	Male Cases n (%)	Female Cases n (%)
<20	1 (2.0%)	2 (3.9%)
20–30	2 (3.9%)	3 (5.9%)
30–40	4 (7.8%)	5 (9.8%)
40–50	5 (9.8%)	6 (11.8%)
50–60	7 (13.7%)	6 (11.8%)
60–70	5 (9.8%)	5 (9.8%)
Total	**24 (47.0%)**	**27 (53.0%)**

Table 2 shows the distribution of cholelithiasis cases by age group and gender. The number of male cases increased steadily from 1 in the under 20 age group to a peak of 7 in the 50–60 age group, then slightly decreased to 5 in the 60–70 group. Female cases followed a similar trend, peaking at 6 in the 40–50 age group. **(Table 2)**

Table 3: Distribution of Fasting Serum Glucose Levels Among Cholelithiasis Patients (n = 51)

Fasting Serum Glucose Levels	Number of Patients	Percentage (%)
Normal (70–100 mg/dL)	22	43.1%
Pre-diabetes (100–126 mg/dL)	11	21.6%
Overt Diabetes (>126 mg/dL)	18	35.3%

Table 3 presents fasting serum glucose levels. Normal glucose levels (70–100 mg/dL) were found in 22 patients (43.1%), pre-diabetes (100–126 mg/dL) in 11 patients (21.6%), and overt diabetes (>126 mg/dL) in 18 patients (35.3%). **(Table 3)**

Table 4: Distribution of HbA1c Levels Among Cholelithiasis Patients (n = 51)

HbA1c Category	Number of Patients	Percentage (%)
Non-diabetic (<5.5)	20	39.2%
Pre-diabetes (5.5–6.5)	13	25.5%
Diabetes with good control (6.5–7.5)	8	15.7%
Diabetes with poor control (>7.5)	10	19.6%

Table 4 presents the distribution of HbA1c levels. Non-diabetic patients (HbA1c <5.5) were 20 (39.2%), pre-diabetic (5.5–6.5) were 13 (25.5%), diabetic with good control (6.5–7.5) were 8 (15.7%), and diabetic with poor control (>7.5) were 10 (19.6%). **(Table 4)**

Table 5: Distribution of Serum Lipid Parameters Among Study Participants (n = 51)

Sample Size (n=51) with Range			
Serum Parameter	**Borderline n (%)**	**Desirable n (%)**	**High Risk n (%)**
HDL	31 (60.8%)	17 (33.3%)	3 (5.9%)
TGs	27 (52.9%)	21 (41.2%)	3 (5.9%)
Cholesterol	24 (47.1%)	18 (35.3%)	9 (17.6%)
LDL	21 (41.2%)	21 (41.2%)	9 (17.6%)

Table 5 presents the distribution of serum lipid parameters among study participants (n = 51). For HDL, 31 patients were classified as borderline, 17 as desirable, and 3 as high risk. Triglycerides (TGs) showed 27 borderline, 21 desirable, and 3 high-risk cases. Cholesterol levels were borderline in 24 patients, desirable in 18, and high risk in 9. LDL values were borderline and desirable in 21 patients each, with 9 classified as high risk. **(Table 5)**

DISCUSSION

This study revealed a high frequency of diabetes mellitus among patients diagnosed with cholelithiasis, with 35.3% showing overt diabetes based on fasting glucose levels and 35.3% (18 out of 51) having elevated HbA1c values indicating poor or moderate glycemic control. These findings reinforce the significant metabolic overlap between gallstone disease and diabetes mellitus (DM), especially among females, as seen in the present study. The prevalence of gallstone disease (GSD) varies globally, with reported rates ranging from 10% to 20% in Western populations [21], and differing by ethnicity and region [22, 23]. Our findings align with previous reports indicating high frequency of DM among the patients diagnosed with GSD [24, 25].

The association between T2DM and gallstones has been explored extensively. Diabetes-related alterations in gallbladder motility and bile composition are critical contributors to gallstone formation [26, 27]. Insulin resistance and hyperinsulinemia promote cholesterol supersaturation in bile, accelerating lithogenesis [28, 29]. Additionally, diabetic autonomic neuropathy may impair gallbladder emptying, prolonging bile stasis [30-32].

Obesity, frequently comorbid with T2DM, further exacerbates gallstone risk by enhancing cholesterol secretion and altering bile acid metabolism [33-35]. The observed BMI distribution in our cohort, with a notable proportion of overweight and obese patients, supports this multifactorial risk model.

Pharmacological management in diabetic patients also influences gallstone risk. For example, metformin usage has been associated with a reduced incidence of gallstones, potentially via improved insulin sensitivity [36]. Conversely, poor glycemic control may exacerbate gallbladder dysfunction and increase gallstone formation [37].

Our findings underscore the need for vigilant screening for gallstone disease in patients with DM, especially considering the rising global diabetes prevalence and its complications [38]. Early diagnosis and management may mitigate gallstone-related morbidity in this high-risk group.

In summary, the interplay of metabolic disturbances, altered gallbladder motility, and obesity in DM patients creates a permissive environment for gallstone formation. Further prospective studies are warranted to delineate the mechanisms and assess interventions that might reduce gallstone risk in diabetic populations [39, 40].

CONCLUSION

The study demonstrates a significant frequency of diabetes mellitus among patients diagnosed with gallstones. The findings highlight the importance of regular screening for diabetes in individuals with gallstone disease, given the shared metabolic risk factors and pathophysiological mechanisms. Early identification and management of diabetes in this population may contribute to better clinical outcomes and reduce gallstone-related complications. Further research is needed to explore targeted preventive and therapeutic strategies for patients with coexisting diabetes and gallstones.

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