

PREVALENCE AND RISK FACTORS OF GALLSTONES AMONG
PATIENTS UNDERGOING ULTRASONOGRAPHY AT HAYATABAD
MEDICAL COMPLEX PESHAWAR

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DOI: <https://doi.org/10.5281/zenodo.22938003>

Keywords

Gallstones, Cholelithiasis,
Ultrasonography, Risk factors,
Abdominal pain, Magnetic
Resonance Imaging

Article History

Received: 17 June 2026

Accepted: 08 September 2026

Published: 24 September 2026

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Abstract

Background: Gallstone disease is a common condition influenced by demographic, metabolic, and clinical factors. Abdominal ultrasonography is widely used for the detection and characterization of gallstones. This study aimed to determine the occurrence and describe the demographic, clinical, metabolic, and ultra-sonographic characteristics of gallstones among patients undergoing abdominal ultrasonography at Hayatabad Medical Complex, Peshawar, Pakistan.

Methods: A descriptive cross-sectional study was conducted over four months at the Radiology Department of Hayatabad Medical Complex. A total of 377 patients undergoing abdominal ultrasonography were recruited using non-probability convenience sampling. Participants aged 20–80 years were eligible, while those with previous cholecystectomy or receiving treatment for gallstones were excluded. Demographic and clinical information, including age, sex, residence, abdominal pain location, obesity, hypertension, and diabetes mellitus, was recorded. Gallstone number and size were assessed using abdominal ultrasonography. Data were analyzed using SPSS version 22, with descriptive statistics presented as frequencies, percentages, means, and standard deviations.

Results: Of the 377 participants, 323 (85.7%) were female and 54 (14.3%) were male, with a mean age of 50.76 ± 17.68 years. Most participants were from urban areas (62.1%). Multiple gallstones were identified in 259 (68.7%) participants, while 118 (31.3%) had a single stone. Gallstone size ranged from 1 to 122 mm, with stones measuring 6–10 mm representing the most frequent size category (38.7%). Obesity was present in 240 (63.7%) participants, hypertension in 174 (46.2%), and diabetes mellitus in 127 (33.7%). Upper-right-quadrant pain was the most frequently reported pain location (41.1%), followed by hypochondriac (30.0%) and epigastric (28.9%) pain.

Conclusion: Gallstones were commonly identified in patients undergoing abdominal ultrasonography, with multiple stones predominating. Female sex, obesity, hypertension, and diabetes mellitus were frequently observed. Ultrasonography remains valuable for detecting and characterizing gallstones in patients with suspected biliary disease.

Introduction

Gallstone disease, or cholelithiasis, is one of the most common disorders of the biliary system and represents an important cause of abdominal pain, healthcare utilization, and surgical intervention worldwide. Gallstones develop when the physicochemical balance of bile is disturbed, resulting in the formation of cholesterol or pigment stones within the gallbladder or biliary tract [1]. Although many gallstones remain asymptomatic, symptomatic disease may manifest as biliary colic or progress to complications such as acute cholecystitis, choledocholithiasis, cholangitis, and gallstone pancreatitis [2]. The clinical and economic burden of gallstone disease varies considerably among populations and geographic regions, reflecting differences in demographic characteristics, metabolic factors, genetics, lifestyle, and methods of detection [3]. Recent epidemiological evidence indicates that gallstones affect approximately 6% of the global population, although prevalence varies substantially according to age, sex, geographic region, population characteristics, and diagnostic modality [4,5]. A systematic review and meta-analysis of studies published between 2000 and 2023, involving more than 32 million participants, estimated a pooled prevalence of 6.1%, with higher prevalence among women and increasing prevalence with advancing age [5]. Gallstone disease has also been reported to be associated with increasing metabolic risk, including obesity and other components of metabolic dysfunction [6,7].

The development of gallstones is multifactorial. Established determinants include increasing age, female sex, obesity, genetic susceptibility, pregnancy-related hormonal changes, rapid weight loss, and metabolic abnormalities [8]. Obesity is associated with increased hepatic cholesterol secretion and cholesterol supersaturation of bile, thereby contributing to cholesterol stone formation [9]. Diabetes and other metabolic abnormalities have also been

associated with gallstone disease, although the magnitude and independence of individual associations vary among populations [6,8]. Genetic factors may further influence susceptibility through their effects on cholesterol metabolism, bile composition, gallbladder motility, and enterohepatic circulation [10]. Abdominal pain is a frequent reason for patients with suspected biliary disease to undergo diagnostic imaging. However, the relationship between abdominal symptoms and gallstones is not always straightforward. Gallstones may remain asymptomatic, while abdominal pain can result from several gastrointestinal, hepatobiliary, and non-abdominal conditions [11]. Right upper-quadrant pain is classically associated with biliary pathology, but symptoms may also be reported in other regions of the upper abdomen [12]. Consequently, imaging is important for establishing the presence of gallstones and differentiating gallstone-related pathology from other causes of abdominal symptoms.

Abdominal ultrasonography is widely used as the initial imaging modality for suspected gallstone disease because it is non-invasive, readily available, relatively inexpensive, does not expose patients to ionizing radiation, and can demonstrate gallstones, gallbladder wall abnormalities, biliary dilatation, and other associated findings [13]. On ultrasound, gallstones typically appear as echogenic structures that may demonstrate posterior acoustic shadowing and mobility with changes in patient position [14]. Ultrasonography is therefore particularly useful in clinical settings where a large number of patients present with abdominal pain and require evaluation for hepatobiliary disease. More advanced imaging techniques, including computed tomography and magnetic resonance cholangiopancreatography, may be used when complications or common bile duct stones are suspected [15].

The epidemiology of gallstone disease has been investigated extensively in many countries; however, population-specific information remains important because risk-factor patterns and disease characteristics may differ between regions. Studies from Pakistan have also demonstrated the occurrence of gallstone disease and associations with demographic and clinical characteristics (16). Local evidence is particularly relevant for healthcare planning because Hayatabad Medical Complex is a major tertiary-care hospital serving patients from Peshawar and surrounding areas. The available literature from the region does not fully characterize the demographic distribution, clinical presentation, ultrasound characteristics, and selected metabolic risk factors among patients undergoing ultrasonography for abdominal pain at this institution. Therefore, the present study was conducted to investigate gallstone occurrence among patients undergoing abdominal ultrasonography at Hayatabad Medical Complex, Peshawar, and to describe selected demographic, clinical, metabolic, and ultrasonographic characteristics of the affected population. The study specifically examined age, sex, residence, obesity, diabetes mellitus, hypertension, abdominal-pain location, and ultrasound-determined gallstone number and size. The findings may contribute to the local evidence base and support improved recognition and diagnostic evaluation of patients presenting with abdominal pain and suspected gallstone disease.

Methodology

A descriptive cross-sectional study was conducted at Hayatabad Medical Complex (HMC), Peshawar, Pakistan. The study was conducted over a period of four months and included patients presenting for abdominal ultrasonography. A total of 377 participants were included in the study. The sample size was calculated using the RaoSoft sample-size calculator. Participants were selected using a non-probability convenience sampling technique. Patients aged 20–80 years who presented for abdominal ultrasonography were eligible for inclusion. Patients with a previous history of cholecystectomy or those who were currently receiving treatment for gallstones or

undergoing gallstone-related surgery were excluded. Data were collected from patients undergoing abdominal ultrasonography at HMC. Relevant demographic and clinical information was recorded, including age, sex, residence, abdominal-pain location, obesity, diabetes mellitus, and hypertension.

All participants underwent abdominal ultrasonography in the Radiology Department of Hayatabad Medical Complex, Peshawar, using a diagnostic ultrasound system with an appropriate abdominal transducer (17). The gallbladder was examined in the supine position using longitudinal and transverse views, with left lateral decubitus positioning when required to improve visualization and assess stone mobility. Gallstones were identified on grayscale ultrasonography as echogenic intraluminal foci, particularly when associated with posterior acoustic shadowing and mobility with positional change (18). The presence of gallstones, number (single or multiple), and size in millimeters were recorded on the structured data-collection form and subsequently entered into the study database for analysis.

Ethical approval was obtained from the relevant ethical review committee of Hayatabad Medical Complex, Peshawar, before commencement of the study. All participants were informed about the study purpose and procedures, and written informed consent was obtained prior to data collection. Participation was voluntary, and confidentiality of participants' information was maintained throughout the study. Data were entered and analyzed using the Statistical Package for the Social Sciences (SPSS), version 22. Descriptive statistics were used to summarize the study variables, with categorical variables presented as frequencies and percentages and continuous variables summarized using appropriate descriptive measures.

Results

A total of 377 participants were included in the study. All participants underwent abdominal ultrasonography, and gallstones were reported on ultrasonographic examination. The majority of participants were female (85.7%), while males accounted for 14.3%. The mean age of the participants was 50.76 ± 17.68 years, with a median age of 45 years and an age range of 20–

89 years. Regarding residence, 62.1% of participants were from urban areas, whereas 37.9% were from rural areas as shown in table 1.

Table 1: Demographic characteristics of the study participants (n = 377)

Variable	Category	n	%
Gender	Male	54	14.3
	Female	323	85.7
Residence	Rural	143	37.9
	Urban	234	62.1
Variable	Mean $\pm$ SD	Median	Minimum-Maximum
Age (years)	50.76 $\pm$ 17.68	45	20-89

Table 2: Ultrasonographic characteristics of gallstones (n = 377)

Variable	Category	n	%
Number of gallstones	Single	118	31.3
	Multiple	259	68.7
Gallstone size (mm)	1-5	84	22.3
	6-10	146	38.7
	11-15	47	12.5
	16-20	65	17.2
	21-25	30	8.0
	26-34	3	0.8
	122	2	0.5

The ultrasonographic characteristics of gallstones are presented in Table 2. Multiple gallstones were more frequently reported than single gallstones. Among the 377 participants, 259 (68.7%) had multiple gallstones, while 118 (31.3%) had a single gallstone. The reported

gallstone sizes ranged from 1 mm to 122 mm. The most frequently observed individual stone size was 9 mm (39 participants, 10.3%), followed by 6 mm (32 participants, 8.5%), and 4 mm and 8 mm (30 participants each, 8.0%).

Table 3. Selected metabolic and clinical characteristics of the participants (n = 377)

Variable	Category	n	%
Obesity	Yes	240	63.7
	No	137	36.3
Hypertension	Yes	174	46.2
	No	203	53.8
Diabetes mellitus	Yes	127	33.7
	No	250	66.3

Table 3 presents the distribution of selected metabolic and clinical characteristics. Among the selected clinical characteristics, obesity was the most frequently reported condition, affecting 63.7% of participants. Hypertension was present in 46.2%, while diabetes mellitus was reported in 33.7% of the study population.

Table 4. Distribution of abdominal pain according to location (n = 377)

Abdominal pain location	n	%
Upper right quadrant	155	41.1
Hypochondriac region	113	30.0

Epigastric region	109	28.9
Total	377	100.0

Table 4 shows The distribution of abdominal pain according to anatomical. Upper right quadrant pain was the most frequently reported location, occurring in 155 participants (41.1%). Hypochondriac-region pain was reported by 113 participants (30.0%), while 109 participants (28.9%) reported epigastric pain.

Discussion

Gallstone disease is a significant health concern worldwide, with varying prevalence rates reported across different regions. The current study employed abdominal ultrasonography to diagnose gallstones and collected data on patient demographics, symptoms, and gallstone characteristics. According to previous study, gallstone cases in female (64.5%) were almost double than male (34.6%), In this study a diverse distribution of abdominal pain, with 41.1% of patients experiencing upper right quadrant pain, 30% reporting hypochondriac region pain, and 28% having Epigastric region pain. These findings suggest that gallstone-related pain can manifest in various locations, emphasizing the importance of comprehensive clinical evaluations. Notably, obesity (63.7%), hypertension (46.2%), and diabetes mellitus (33.7%) were prevalent among the study population, consistent with established risk factors for gallstone disease.

Similar study was conducted by Elnair in 2016, the authors conducted a similar analysis and it was found that the pain caused in the right upper quadrant was mostly due gall bladder disease, where 52.9% was the frequency of gall bladder stones, and 29.4% with acute cholecystitis. In the same study, examination of liver found that 15.7% caused by liver disease, out of which 0.45% was the frequency of fatty liver conditions, 0.09% liver cyst, 0.08% abscess, 0.09% cancer and 0.08% hepatitis (19). In this study found that gallstone size varied, with a common range of 8mm to 12mm. This size distribution is consistent with previous reports, highlighting the importance of precise diagnostic imaging and tailored treatment strategies. The presence of gallstones was confirmed through abdominal ultrasonography,

a widely recognized diagnostic tool for gallstone disease. In similar study was conducted in America in 2020 that gall stone (15%) and biliary sludge (15%), whereas 54% were idiopathic acute pancreatitis. The most common challenges we faced were delay in hospital admission (59%) and delay in hospital diagnosis (20%). Other challenges are non-adherence of patient party and lack of investigation facility, physician's poor knowledge about current guidelines. We were able to give early aggressive fluid to only 18% patients as per current guideline (20).

The study population comprised 377 patients, with 37.4% residing in rural areas and 60.5% in urban areas. This demographic distribution highlights potential disparities in healthcare access and environmental factors contributing to gallstone prevalence. Similar study was conducted at two largest tertiary care governments-ran teaching hospitals of Karachi. These two hospitals provide tertiary care facilities free of cost, so they are the primary care providers for the rural dwellers of the city who cannot afford the expensive treatments at other hospitals. 410 participants who were the rural dwellers from the Karachi city area were enrolled in the above-mentioned period through the outpatient department (OPD) of the respective hospitals, and were diagnosed on history, physical examination, and ultrasound examination (21). In this study contributes to the existing literature on gallstone disease, highlighting the prevalence and characteristics of gallstones among patients with abdominal pain. The findings have implications for clinical practice, emphasizing the need for comprehensive evaluations, precise diagnostic imaging, and targeted interventions. Clinicians should be aware of the potential for gallstone-related pain to manifest in various locations and recognize the significance of obesity, hypertension, and diabetes mellitus as risk factors. The study's results also emphasize the value of abdominal ultrasonography as a diagnostic tool. Similar study was conducted that treatment of gallstone disease, including cholecystectomy, is common and imparts risk of

morbidity and mortality on patients as well as significant costs to the healthcare system. With the significant costs, morbidity, and mortality associated with gallstone disease it becomes important to identify risk factors that can be mediated and measures instituted for prevention of gallstones (22).

The present study has several limitations. This study was conducted at a single tertiary-care hospital in Peshawar using a non-probability convenience sampling technique, which may limit the generalizability of the findings to the wider population. The cross-sectional design provides information on the distribution of gallstones and related characteristics at one point in time but does not establish temporal or causal relationships. Data were also limited to the demographic, clinical, and ultrasonographic variables included in the study questionnaire; therefore, other potentially relevant factors may not have been assessed. In addition, the study relied primarily on descriptive analysis, limiting the assessment of statistical associations between potential risk factors and gallstone occurrence.

Conclusion

This study characterized the demographic, clinical, metabolic, and ultrasonographic features of patients with gallstones at Hayatabad Medical Complex, Peshawar. Females predominated, while multiple stones were more common than solitary stones. Obesity, hypertension, and diabetes mellitus were frequently reported risk factors, and right upper-quadrant pain was the most common presentation. These findings contribute to the limited local evidence on gallstone disease in a tertiary-care setting. Abdominal ultrasonography remains a practical, non-invasive, and accessible method for detecting and characterizing gallstones. Further studies using analytical designs are warranted to evaluate potential associations between metabolic factors and gallstone disease.

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