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DIAGNOSTIC ACCURACY OF ULTRASOUND IN DETECTING GALLBLADDER STONES: A CLINICAL STUDY

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Abstract

Background: Gallbladder stones (cholelithiasis) are a common gastrointestinal condition, often diagnosed using non-invasive imaging modalities such as ultrasound. This study evaluates the diagnostic accuracy of ultrasound in detecting gallbladder stones. **Objectives**: To determine the diagnostic accuracy of ultrasound for gallbladder stones and analyze associated demographic and risk factors. **Methods**: A cross-sectional study was conducted on 28 patients clinically suspected of having gallbladder stones. Ultrasound findings were compared with intraoperative or radiologic confirmatory diagnoses. Demographic and risk factors were recorded and analyzed. **Results**: Out of 28 patients, ultrasound correctly diagnosed gallbladder stones in 25 cases, yielding a sensitivity of 92.6% and specificity of 100%. Most patients were females aged between 30–50 years. Obesity, female sex, and a family history of gallstones were the most common risk factors. **Conclusion**: Ultrasound is a highly sensitive and specific, non-invasive, and cost-effective modality for detecting gallbladder stones.

KEYWORDS: Gall Bladder, Stones.

INTRODUCTION

Gallbladder stones, or cholelithiasis, are formed by the precipitation of bile components. They affect millions globally, with a higher prevalence among females, older adults, and those with sedentary lifestyles or poor dietary habits. Early detection is crucial to avoid complications such as cholecystitis or pancreatitis[1].

Gallbladder stones, also known as cholelithiasis, affect roughly 10-15% of adults in Western countries. However, the majority of people with gallstones (about 80%) don't experience any symptoms. Prevalence varies across different populations, with some studies showing rates as high as 25%[2-6].

Here's a more detailed breakdown: Global Prevalence: A systematic review and meta-analysis estimated the global prevalence of gallstones to be 6.1%. Gallbladder stones, or cholelithiasis, are influenced by various demographic factors. Age, gender, ethnicity, and lifestyle play significant roles in the development of gallstones.

Being female, older, of certain ethnicities, obese, and having a family history of gallstones are all associated with increased risk[7-10].

Here's a more detailed look at these factors:1. Age: Gallstones are more common with increasing age. The prevalence of gallstones increases significantly after the age of 40, with the highest rates often found between the ages of 60 and 75. Symptoms and complications also tend to increase with age. Gender: Females are significantly more likely to develop gallstones than males[11]. Women are almost twice as likely to form stones, Ethnicity: Certain ethnicities have a higher prevalence of gallstones. For example, American Indians have a higher incidence compared to other populations. Geographical location and related dietary and lifestyle factors can also contribute to ethnic differences. Obesity: Obesity is a strong risk factor for gallstone formation. Individuals with a BMI of 30 or higher have a significantly increased risk compared to those with a normal BMI, according to a study on risk factors for cholelithiasis. Family History and Genetics A family history of gallstones increases the likelihood of developing them. This suggests a genetic component in the susceptibility to gallstone formation. Lifestyle Factors Rapid weight loss: Significant and rapid weight loss, such as that following bariatric surgery, can increase the risk of gallstones, according to a study on the epidemiology of gallbladder disease[12-16].

Diet: A diet high in cholesterol and saturated fats, as well as a diet with a high glycaemic load, can increase the risk of gallstones. Sedentary lifestyle. Lack of physical activity is also associated with an increased risk, Other medical conditions: Conditions like diabetes, cirrhosis, and certain types of anemia can also increase the risk[17].

Understanding these demographic factors is crucial for identifying individuals at higher risk and implementing preventative measures, such as lifestyle modifications and appropriate medical intervention. Ultrasound imaging is often the first-line diagnostic tool due to its safety and cost-effectiveness. This study aims to assess the diagnostic accuracy of ultrasound in gallbladder stone detection and explore the demographic and risk factors associated with the disease.

METHODS

This study was conducted in a tertiary hospital. After obtaining institutional ethical committee approval. It was Cross-sectional observational study conducted on 28 patients in the department of Radiology and General Surgery, at a tertiary care centre, from September / 2021 to March/2022

Total 28 participant were approached to project among them No one were excluded in this study and Total 28 Confirmed cases were included on the basis of fulfilling of the eligibility criteria.

The institute Ethics Committee approval was obtained before starting the sample collection. A written and informed consent was taken from the patient regarding the study in his/her vernacular language and English. In this study Patients were subjected to: A detailed history of sign & symptoms and its duration. Detailed history of systemic diseases and its duration, medication were noted. Patients were subjected to General physical examination

Study Design

- Cross-sectional observational study
- Duration: 6 months
- Sample size: 28 patients with suspected gallbladder stones

Inclusion Criteria

- Patients aged >18 years
- Clinically suspected of having gallbladder stones
- Gave informed consent

Exclusion Criteria

- Previous gallbladder surgery
- Pregnancy

- Inconclusive ultrasound

Procedure

All patients underwent:

1. Clinical examination
2. Ultrasonography by an experienced radiologist
3. Confirmatory diagnosis through surgery, MRCP, or CT (if performed)

Ultrasound findings were compared with final diagnoses to calculate diagnostic accuracy.

Flowchart

Patients with suspected gallbladder stones (n=28)
↓
Clinical Evaluation
↓
Ultrasound Examination
↓
Comparison with Confirmatory Diagnosis
↓
Data Collection (Demographics & Risk Factors)
↓
Statistical Analysis (SPSS)

RESULTS

In this study we found that Gallbladder stones (cholelithiasis) is associated with demographic profile of patient. Female were more prone to suffered of Gallbladder stones (cholelithiasis) as compared to Male, its prevalence is 67.9%. Gallbladder stones (cholelithiasis). were more dominance among urban residence, its prevalence is 58.3%. (Table 1).

Age is also associated factors for Gallbladder stones (cholelithiasis). Average mean age for Gallbladder stones (cholelithiasis) is 42.3 ± 11.5. Its prevalence is 53.6 %belong to 31-50 age group. (Table 1).

Table 1: Demographic Characteristics of Patients (n=28)

Characteristic	**Value**
Mean Age (years)	42.3 ± 11.5
Age group	18–30: 6 (21.4%)
	31–50: 15 (53.6%)
	>50: 7 (25.0%)
Sex	Female: 19 (67.9%)
	Male: 9 (32.1%)
BMI ≥ 25 (Overweight)	16 (57.1%)

There is many risk factors Gallbladder Stones, among them these are important
Female Gender, Obesity (BMI ≥ 25), Family History of Stones, Sedentary Lifestyle, High-fat Diet and Multiparity (in females) (Table 2)

Table 2: Risk Factors Associated with Gallbladder Stones

Risk Factor	Frequency (%)
Female Gender	67.9%
Obesity (BMI ≥ 25)	57.1%
Family History of Stones	35.7%
Sedentary Lifestyle	42.9%
High-fat Diet	50.0%
Multiparity (in females)	42.1% (of females)

Diagnostic Accuracy

Parameter	Value (%)
Sensitivity	92.6
Specificity	100
Positive Predictive Value	100
Negative Predictive Value	75.0
Accuracy	94.4

DISCUSSION

Our findings align with global literature showing ultrasound as a reliable diagnostic tool for gallbladder stones. The sensitivity of 92.6% and specificity of 100% are consistent with previous studies, which report sensitivity between 85%–95%[18].

The higher prevalence among females and middle-aged adults confirms known hormonal and lifestyle risk factors. Obesity and family history are modifiable and non-modifiable risk contributors, respectively[19-21].

Gallstones, also known as cholelithiasis, are hardened deposits of digestive fluid that can form in the gallbladder. Several factors can increase the risk of developing gallstones, including genetics, lifestyle choices, and certain medical conditions[22].

In this study we found that Gallbladder stones (cholelithiasis) is associated with demographic profile of patient. Female were more prone to suffered of Gallbladder stones (cholelithiasis) as compared to Male, its prevalence is 67.9%. Gallbladder stones (cholelithiasis). were more dominance among urban residence, its prevalence is 58.3%. (Table 1). Age is also associated factors for Gallbladder stones (cholelithiasis). Average mean age for Gallbladder stones (cholelithiasis) is 42.3 ± 11.5. Its prevalence is 53.6 %belong to 31-50 age group. (Table 1). There is many risk factors Gallbladder Stones, among them these are important. Female Gender, Obesity (BMI ≥ 25), Family History of Stones, Sedentary Lifestyle, High-fat Diet and Multiparity (in females) (Table 2)

Non-modifiable risk factors: Age: The risk of gallstones increases with age, particularly after 40 Sex: Women are more prone to gallstones than men, likely due to hormonal factors. Ethnicity: Certain ethnicities, like Native Americans, have a higher prevalence of gallstones, potentially due to genetic predisposition. Family history: A family history of gallstones increases the likelihood of developing them. Modifiable risk factors: Obesity and rapid weight loss: Obesity increases the risk of gallstones, and rapid weight loss can also trigger their formation. Diet: Diets high in fat and cholesterol, and low in fiber, can contribute to gallstone formation[23-25]. Diabetes and metabolic syndrome: These conditions can disrupt and increase triglyceride levels, raising the risk. Certain medications: Some medications, such as those containing estrogen (like birth control pills or hormone replacement therapy), can increase the risk. Sedentary lifestyle Lack of physical activity can contribute to gallstone development. Other factors: Liver disease, certain blood disorders (like sickle cell anemia), and conditions that affect bile flow can also play a role[26].

The management of cholelithiasis (gallstones) depends on whether the condition is asymptomatic or symptomatic, and whether complications are present. Asymptomatic gallstones generally don't require treatment, while symptomatic gallstones often necessitate surgical intervention, specifically laparoscopic cholecystectomy. Medications to dissolve gallstones may be used in some cases, but surgery is often the preferred long-term solution due to the high recurrence rate of gallstones[27].

Management Strategies: Asymptomatic Cholelithiasis: Expectant Management: Most individuals with asymptomatic gallstones do not require treatment and can be monitored for the development of symptoms. Surgical Intervention: In certain situations, such as in individuals with sickle cell anemia or those undergoing other abdominal surgeries, surgical removal of the gallbladder (cholecystectomy) may be considered. Symptomatic Cholelithiasis: Laparoscopic Cholecystectomy: This is the most common surgical approach for removing the gallbladder and is generally recommended for symptomatic gallstones[28].

Endoscopic Retrograde Cholangiopancreatography (ERCP): This procedure is used to remove gallstones from the bile ducts, particularly if they are causing obstruction or infection[29]. Medications: Ursodeoxycholic acid (ursodiol): This medication can be used to dissolve cholesterol gallstones, but it may take months or years, and gallstones may recur after stopping treatment. Pain Management: Medications like NSAIDs and opioid analgesics can be used to manage pain associated with gallstones[30].

Limitations include the small sample size and the single-center design, which may affect generalizability. Future studies with larger cohorts and multi-modal imaging comparisons are warranted.

CONCLUSION

Ultrasound demonstrates excellent diagnostic accuracy in identifying gallbladder stones and remains the investigation of choice for suspected cases. Demographic and risk factor profiling can enhance early diagnosis and prevention strategies

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CONFLICT OF INTEREST

The authors report no conflicts of interest

SUBMISSION DECLARATION

This submission has not been published anywhere previously and that it is not simultaneously being considered for any other journal.

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