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Limits and Advantages of CT scan in Diagnosing Cholelithiasis Among Adults Aged 18–60 Years: A Clinical Study

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ABSTRACT

Background: Cholelithiasis, or gallstone disease, is a common biliary disorder, especially among adults. While ultrasound is the first-line imaging modality, CT scan is increasingly used in emergency settings. Objective: To assess the limitations and advantages of CT scan in diagnosing cholelithiasis in the 18–60 years age group and evaluate associated risk factors. Methods: A prospective observational study was conducted on 56 patients diagnosed or suspected of having cholelithiasis. CT scan findings were compared with clinical and ultrasound results. Demographic and risk factor data were analysed. Results: CT scan detected gallstones in 78.6% of cases, with sensitivity reduced in cases of radiolucent cholesterol stones. CT was advantageous in detecting complications like gallbladder perforation, pancreatitis, and cholecystitis. Major risk factors were female gender (66%), obesity (BMI >25: 62.5%), and sedentary lifestyle (53.6%). Conclusion: CT scan is useful in diagnosing complicated cholelithiasis and in acute settings, though limited in identifying radiolucent stones. A multi-modality approach improves diagnostic accuracy.

KEYWORDS: Cholelithiasis, ultrasound.

INTRODUCTION

Cholelithiasis refers to the formation of gallstones within the gallbladder, a condition affecting up to 20% of the adult population globally. In India, dietary and lifestyle changes have contributed to a rising prevalence. Imaging is pivotal for diagnosis[1].

The prevalence of gallstones in India varies, but it's generally reported to be between 2% and 29%. Studies have shown a higher prevalence in North India compared to South India. Additionally, there's a noticeable trend of gallstone disease increasing in younger individuals in India[2-4]. Key points about gallstone prevalence in India: Regional Differences:

A significant difference exists between North and South India, with North India exhibiting a seven times higher prevalence of gallstones than South India. Age Trends: Recent studies indicate an increasing incidence of gallstone disease in younger individuals, particularly in the 20-40 age group. This is potentially linked to factors

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like dietary changes, obesity, and lifestyle shifts. Gender: While the prevalence varies, females are generally more commonly affected by gallstones than males[5-9].

Stone Composition: The composition of gallstones also differs regionally. Cholesterol and mixed stones are more common in North and East India, while pigment stones are more prevalent in South India. Symptomatic vs. Asymptomatic: Gallstone disease can be asymptomatic (without noticeable symptoms) or symptomatic, presenting with symptoms like abdominal pain, nausea, or vomiting. Factors Contributing to Gallstone Formation: Age: Older individuals are more susceptible to gallstones[10-13]. Gender: Women are more prone to developing gallstones than men. Obesity: Excess weight is a risk factor for gallstone formation. Diet: A diet high in calories, fat, and low in protein may increase the risk of gallstones. Family History: A family history of gallstones can increase an individual's risk. Other medical conditions: Conditions like diabetes and liver disease can also contribute to gallstone development[[14-17]. In conclusion, cholelithiasis is a common condition in India with varying prevalence across regions and age groups, and it's important to consider lifestyle and dietary factors in its development

Although ultrasonography remains the gold standard, CT scans are increasingly utilized in emergency departments for abdominal pain evaluation. This study explores the diagnostic strengths and weaknesses of CT imaging in cholelithiasis

MATERIALS AND METHODS

This study was conducted in a tertiary hospital. After obtaining institutional ethical committee approval It was prospective observational study conducted on 56 patients in the department of Radiology on the basis of attended in Medicine OPD and department of radiology, at a tertiary care Centre, from March / 2018 to September/2018.

Total 56 participant were approached to project among them No one were excluded in this study and Total 56 were included on the basis of fulling 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
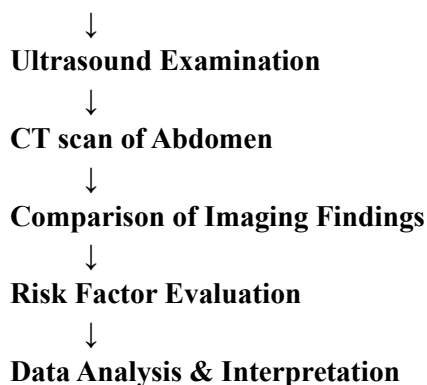
- **Study Design:** Prospective observational study
- **Sample Size:** 56 patients
- **Study Duration:** 12 months
- **Inclusion Criteria:**
o Adults aged 18–60 years
o Clinically suspected or confirmed cholelithiasis
- **Exclusion Criteria:**
o Known malignancy
o Prior cholecystectomy
o Pregnant women
- **Data Collection:**
o CT scan and ultrasound imaging results
o Clinical symptoms, BMI, lifestyle, and family history
o Risk factors categorized into modifiable and non-modifiable
- **Analysis:** Statistical comparison of CT findings with ultrasound results and risk factor distribution

Flowchart – Study Workflow

Patients with RUQ pain (N = 56)
↓
Clinical Assessment & History

↓
Ultrasound Examination
↓
CT scan of Abdomen
↓
Comparison of Imaging Findings
↓
Risk Factor Evaluation
↓
Data Analysis & Interpretation

RESULTS

In this study we found that Cholelithiasis is associated with demographic profile of patient. Average 41.1% of patient is suffered of Cholelithiasis belongs to 31-45 age group.

It means age is important factors for Cholelithiasis. Age is contributary factors of Cholelithiasis

Female (66.1%) were more prone to suffered of Cholelithiasis to male gender. (Table 1)

Prevalence in Urban residence is more as compare to Rural area; its prevalence is 55.3 % of Cholelithiasis (Table 1).

1. Demographic Factors Table 1:

Demographic Parameter	Number (n=56)	Percentage (%)
Age Group (Years)		
18–30	14	25.0
31–45	23	41.1
46–60	19	33.9
Gender		
Male	19	33.9
Female	37	66.1
BMI > 25	35	62.5
Urban Residence	31	55.3

Cholelithiasis have many risk factors among these are most important risk factors Female Gender, BMI > 25 (Overweight/Obesity), Sedentary Lifestyle, Family History of Gallstones, High-fat Diet, Diabetes Mellitus and Oral Contraceptive Use (Females)

2. Risk Factors Table 2:

Risk Factor	Number (n=56)	Percentage (%)
Female Gender	37	66.1
BMI > 25 (Overweight/Obesity)	35	62.5
Sedentary Lifestyle	30	53.6
Family History of Gallstones	18	32.1
High-fat Diet	26	46.4

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Risk Factor	Number (n=56)	Percentage (%)
Diabetes Mellitus	11	19.6
Oral Contraceptive Use (Females)	15/37	40.5

CT scan Diagnostic Accuracy:

Parameter	Detected (n=56)	Percentage (%)
Visible Gallstones	44	78.6
Gallbladder Wall Thickening	31	55.4
Pericholecystic Fluid	12	21.4
Pancreatitis Signs	5	8.9
Cholecystitis Signs	18	32.1

DISCUSSION

This study highlighted the usefulness of CT scan in detecting gallstones and associated complications. CT scans are limited in detecting radiolucent cholesterol stones, which are often missed unless calcified. However, CT excels in identifying complications such as pancreatitis, perforation, and emphysematous cholecystitis—conditions where immediate intervention is necessary[18].

Cholelithiasis, or gallstones, is a condition where hardened deposits of digestive fluid form in the gallbladder. Several demographic factors are associated with an increased risk of developing gallstones. These include age, female gender, obesity, and ethnicity, with certain ethnicities having a higher prevalence of gallstones. Additionally, lifestyle factors like diet, physical activity, and smoking habits also play a role[19].

In this study we found that Cholelithiasis is associated with demographic profile of patient. Average 41.1% of patient is suffered of Cholelithiasis belongs to 31-45 age group. It means age is important factors for Cholelithiasis. Age is contributary factors of Cholelithiasis

Female (66.1%) were more prone to suffered of Cholelithiasis to male gender. (Table 1)

Prevalence in Urban residence is more as compare to Rural area; its prevalence is 55.3 % of Cholelithiasis (Table 1).

Age: The risk of developing gallstones increases with age, with prevalence rising in the fourth and fifth decades of life. This is likely due to factors like decreased gallbladder motility and increased cholesterol saturation of bile as people age[20-24].

Gender: Females are more likely to develop gallstones than males. This is often attributed to the effects of estrogen, which can increase cholesterol levels in bile and slow down gallbladder emptying. Pregnancy and oral contraceptive use are also linked to increased risk in women. Ethnicity: Some ethnic groups have a higher prevalence of gallstones compared to others[25]. For example, studies have shown higher rates in some Native American and Hispanic populations compared to other groups. Obesity: Individuals with a higher body mass index (BMI) are at increased risk for gallstones. Obesity can lead to increased cholesterol secretion into bile and reduced gallbladder motility, both of which contribute to gallstone formation[26].

Cholelithiasis, or gallstones, are a common condition with several risk factors, some modifiable and some not. Key risk factors include obesity, female gender, older age, ethnicity (particularly Native American and Mexican American), a family history of gallstones, and certain medical conditions like diabetes and Crohn's disease. Modifiable risk factors include diet, weight, and rapid weight loss[27].

Here's a more detailed breakdown Non-Modifiable Risk Factors: Age: The risk of gallstones increases with age, with a higher prevalence in those over 60. Female Gender: Women are more likely to develop gallstones than men, especially those who have had children or are taking estrogen-based medications. Ethnicity: Certain

ethnicities, like Native Americans and Mexican Americans, have a higher prevalence of gallstones. Family History: Having a family history of gallstones increases your risk. Medical Conditions: Diabetes: People with diabetes have a higher risk, potentially due to higher levels of fatty acids. Cirrhosis: Liver cirrhosis can increase the risk of gallstones. Crohn's Disease: Individuals with Crohn's disease have a higher risk, possibly due to impaired bile salt absorption. Sickle Cell Disease: This condition can increase the risk of gallstones[28]. Cystic Fibrosis: While not explicitly mentioned in the search results, cystic fibrosis can affect bile flow and increase gallstone risk. Abnormalities of the Bile Ducts: Cysts or other structural abnormalities can increase risk. Gallbladder Polyps: These growths can increase risk. Modifiable Risk Factors: Obesity: Excess weight, particularly abdominal fat, increases cholesterol production and the risk of gallstones[29].

Rapid Weight Loss: Losing weight too quickly can disrupt bile composition and increase gallstone formation. Diet: High Cholesterol Diet: Diets high in cholesterol can contribute to gallstone formation. High-Fat Diet: A diet high in saturated and trans fats can increase cholesterol levels and gallstone risk. Low-Fiber Diet: Inadequate fiber intake can also contribute to gallstone development. Physical Activity: A sedentary lifestyle can increase the risk of obesity and gallstones
Lifestyle Factors: Diet: High intake of saturated fats and cholesterol, and low intake of fiber, can increase the risk of gallstones. Physical Activity: A sedentary lifestyle is associated with a higher risk of gallstones. Smoking: Current smokers have an increased risk compared to non-smokers[30]. Other Factors: Family History: Having a family history of gallstones increases the likelihood of developing the condition.
Rapid Weight Loss: Significant and rapid weight loss can also increase the risk of gallstones. Certain Medications: Some medications, such as ceftriaxone, octreotide, and thiazide diuretics, have been associated with an increased risk of gallstones. Certain Medical Conditions: Conditions like cirrhosis, Crohn's disease, and certain types of anemia can also increase the risk[31].
CT can be particularly helpful when ultrasound findings are equivocal due to obesity, bowel gas, or atypical presentation. Most patients were overweight females, aligning with known risk factors for cholelithiasis.

CONCLUSION
CT scan offers critical advantages in diagnosing complex or emergency cases of cholelithiasis but is less sensitive in identifying radiolucent stones compared to ultrasound. It should be used as a complementary tool rather than a primary diagnostic modality. Public awareness of modifiable risk factors (obesity, sedentary habits, diet) is essential for prevention.

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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