

## Role Of Ultrasonography In Diagnosis Of Various Biliary System Pathologies

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**Abstract:** Background: Discuss the role of ultrasound in detecting various gallbladder and biliary tract pathologies in patients presenting as right upper quadrant/epigastric pain/obstructive jaundice especially in emergency situations and demonstrating the incidence of various gallbladder and biliary tract pathologies. Material And Methods: A retrospective observational study of 85 patients having upper abdominal/epigastric pain/obstructive jaundice was carried out at SVP Hospital, ahmedabad. Ultrasound was performed by using MINDRAY RESONA 6 machine. Both curvilinear and linear probes were used for the scanning. Result: The study included 85 patients with 50 female patients and 35 male patients. Most common pathology found was gallbladder calculus (47%). Female gender (72.5%) was more prone for having gallstones than male gender (27.5%). Gallstones were commonly associated with diffuse wall thickening and most common pathology associated with diffuse wall thickening was acute calculus and a calculous cholecystitis with both having a frequency of 30 % each. Gallstones were found a common risk factor for gallbladder perforation as well as gallbladder malignancy. Common pathologies presenting with obstructive jaundice were CBD stones and CBD stricture in which distal CBD was the commonest site for the stones (39%) as well as stricture (50%). In paediatric age group presenting with jaundice common pathologies were choledochal cyst and biliary atresia. Conclusion: Ultrasound is a non-invasive, least expensive, highly sensitive imaging modality and free from radiation for the assessment of the gallbladder and biliary tree pathologies especially in emergency situations. [Gohel S Natl J Integr Res Med, 2022; 13(3): 49-55, Published on Dated: 10/05/2022]

**Key Words:** Ultrasound, Biliary System Pathologies, Gallbladder, Gallstones

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**Introduction:** Biliary system pathologies are considered to be one of the leading causes of the significant morbidity to the patients. Most of the patients with biliary pathologies present with clinical signs and symptoms of right upper quadrant/epigastric pain associated with nausea, vomiting, fever, anorexia and jaundice.

Imaging modalities play a very vital role in diagnosis and planning the management of the patients with suspicion of biliary pathologies. Therefore the need of the imaging modality which is easily available, highly sensitive as well as specific is a need.

Ultrasonography is the modality which is the most helpful, safe, rapid, and relatively less expensive and has no radiation exposure.

Therefore ultrasound is the initial first imaging modality of the choice for the diagnosis of the patients having upper abdominal/epigastric pain/obstructive jaundice and especially in patients with pregnancy as it is free from radiation exposure. Current study focuses on the assessment of various gallbladder and biliary

tract pathologies commonly presenting as upper abdominal/epigastric pain or obstructive jaundice with ultrasonography.

**Material & Methods:** It is as follows.

Study Population: 85 patients.

Type Of Study: Retrospective observational study.

Study Period And Study Age Group: 3 months from April 2022 to June 2022. Age group from 10 - 90 years (Mean age - 54.9 years). No gender predilection was followed.

Study Site: Department of radiodiagnosis - SVP Institute of medical sciences and research Hospital; NHL MMC; Ahmedabad, Gujarat.

Inclusion Criteria: Patients suspected having biliary/gallbladder pathologies with complaints of right upper quadrant pain/epigastric pain/obstructive jaundice.

Exclusion Criteria: None.

Methodology: Patients were evaluated who were sent to the radiology department with the clinical suspicion of biliary tract pathologies.

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Informed consent of the patient was taken prior to the study. Detailed history and pathological investigations were reviewed before scanning.

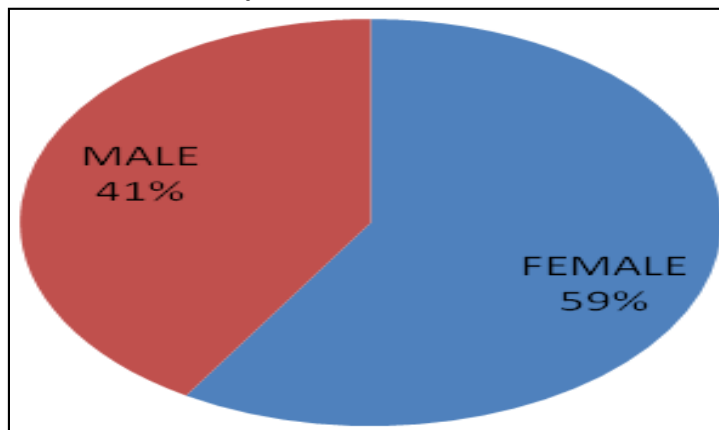
**Patient Preparation:** All the non-emergency patients were instructed to come nil by mouth for at least 6 hours on the day of procedure. All the emergency patients were scanned irrespective of their nil by mouth status.

**Scan Parameters:** USG was performed using the MINDRAY RESONA 6 machine. Both curvilinear

and linear probes were used for the scanning. Patients were examined in supine and left lateral decubitus position with the abdomen exposed from epigastrium to pubic symphysis. Images were recorded and sent to PACS workstation for later review.

**Results:** The study included 85 patients having right upper quadrant pain/epigastric pain/jaundice. The study included 50 female patients and 35 male patients. The mean age of the patients was 54.9 years.

**Graph 1: Gender Distribution**



**Table 1: Frequency Of Pathologies**

Frequency Of Pathologies	
Pathologies	No
GB Calculus	40
GB Polyp	16
IHBR/CHD/CBD Calculus	13
GB Adenomyomatosis	10
CBD Stricture	10
GB Perforation	6
GB Mass Lesion	5
Choledochal Cyst	5
Biliary Atresia	2

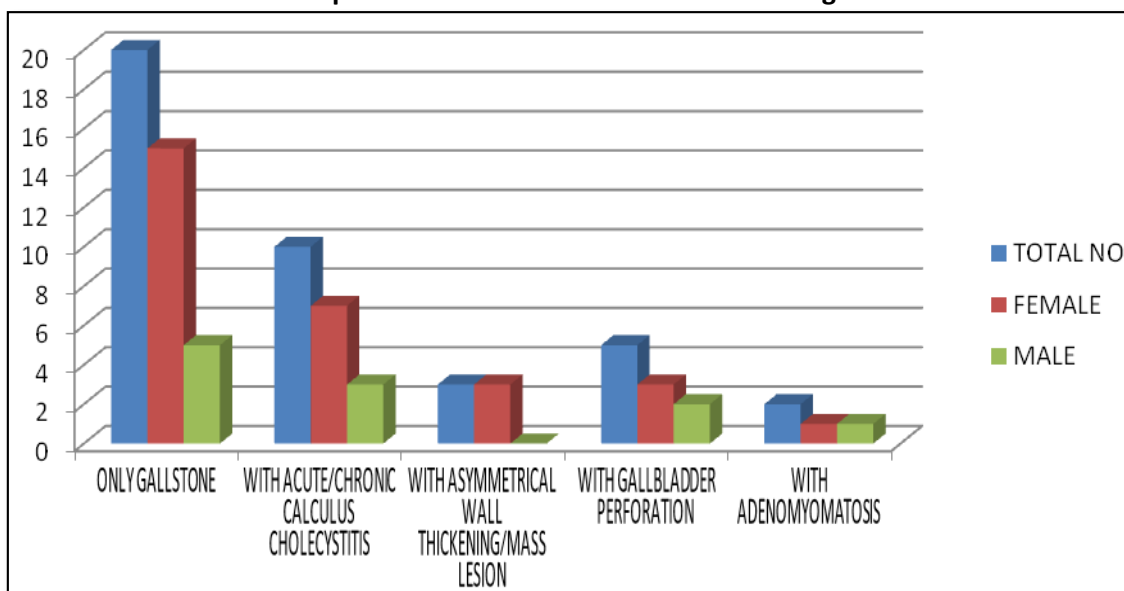
Out of total 85 patients the most common pathology was gallbladder calculus. Many pathologies were associated with each other, out

of which common ones were gallbladder calculus with cholecystitis, perforation and mass lesion.

**Table 2: Gallbladder Calculus And Associated Pathologies**

Gallbladder Calculus And Associated Pathologies	No.	Female	Male
Only Gallstone	20	15	5
Gallstone With Acute/Chronic Calculus Cholecystitis	10	7	3
Gallstone With Asymmetrical Wall Thickening /Mass Lesion	3	3	0
Gallstone With Gallbladder Perforation	5	3	2
Gallstone With Adenomyomatosis	2	1	1
<b>Total</b>	40	29	11

**Graph 1: Gallstones And Associated Pathologies**



Out of all 40 patients with gallstones; Female gender (72.5 %) was more prone for having gallstones than male gender (27.5 %). Most

common pathology associated with gallstone was acute/chronic cholecystitis (25%) and least common one was adenomyomatosis (5%).

**Table 3: Gallbladder Wall Thickening**

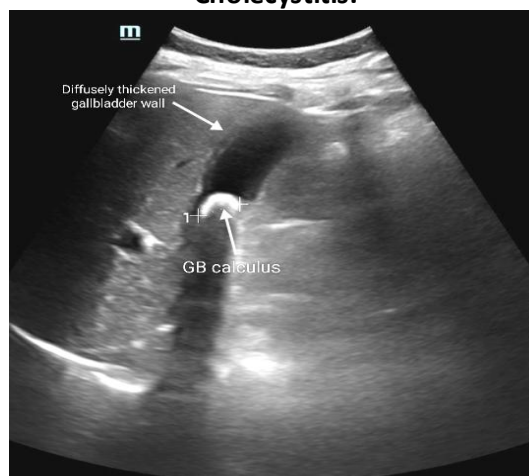
Gallbladder Wall Thickening			
Diffuse			
	No.	Female	Male
Acute Calculus Cholecystitis	6	4	2
Chronic Calculus Cholecystitis	4	3	1
Acute Acalculus Cholecystitis	6	3	3
Associated With Systemic Diseases (I.E. Cirrhosis, Hepatitis, Heart Failure, Dengue Etc.)	4	1	3
<b>Total</b>	<b>20</b>	<b>11</b>	<b>9</b>
Focal			
Asymmetrical- Malignancy	5	4	1
Focal Adenomyomatosis	3	1	2
<b>Total</b>	<b>8</b>	<b>5</b>	<b>3</b>

Out of total 28 patients with gallbladder wall thickening; diffuse wall thickening (71.5 %) was more common than focal wall thickening (28.5 %).

Female gender (60.7 %) was more associated with gallbladder wall thickening than male (39.7%).

Out of total patients with diffuse wall thickening most common pathology was acute calculus and acalculus cholecystitis with both having frequency of 30 % each.

**Image 1: Diffusely Thickened Wall Of Gallbladder With Evidence Of Gallbladder Calculus. Suggesting Acute Calculus Cholecystitis.**



**Image 2: Diffusely Thickened Wall Of No Evidence Of Gallbladder Calculus. Suggesting Acute Acalculus Cholecystitis.**



**Table 4: Gallbladder Perforation**

Gallbladder Perforation	No.	Female	Male
With Acute/Chronic Calculus Cholecystitis	5	3	2
With Acute Acalculus Cholecystitis	1	0	1
<b>Total</b>	<b>6</b>	<b>3</b>	<b>3</b>

Out of total 6 patients with gallbladder perforation 5 patients were having acute/chronic calculus cholecystitis and only 1 patient was having acalculous cholecystitis.

**Table 5: Gallbladder Malignancy**

Gallbladder Malignancy	No	Female	Male
Associated With Gallstone	3	3	0
Not Associated With Gallstone	2	1	1
<b>Total</b>	<b>5</b>	<b>4</b>	<b>1</b>

Out of total 5 patients diagnosed with gallbladder malignancy; most common pathology associated with malignancy was gallstones (60%); and the most common gender was female (80%).

**Image 3A: Gallbladder Is Distended With Sludge And Diffusely Thickened Wall Of Gallbladder Suggesting Acute Acalculus Cholecystitis**



**Image 3B: 5 Days After - Large Pericholecystic Collection Communicating With Gallbladder Through A Rent In Fundal Wall. Suggesting Gallbladder Perforation.**



**Image 4: Intraluminal Echogenic Lesion With Internal Vascularity Arising From The Lateral Wall Of Body Of The Gallbladder. Suggesting Gallbladder Malignancy.**



Out of total 13 patients with CHD/CBD calculi; most common site of calculus was distal CBD (39%). Out of total 10 patients with CBD stricture; most common level of stricture was distal CBD (50 %) and benign stricture (70 %) was more common than malignant one. Out of total 5 patients with choledochal cyst, the most common type (according to Todani et al. classification) was type Ia(30%) and Ib(30%)(Table 6).

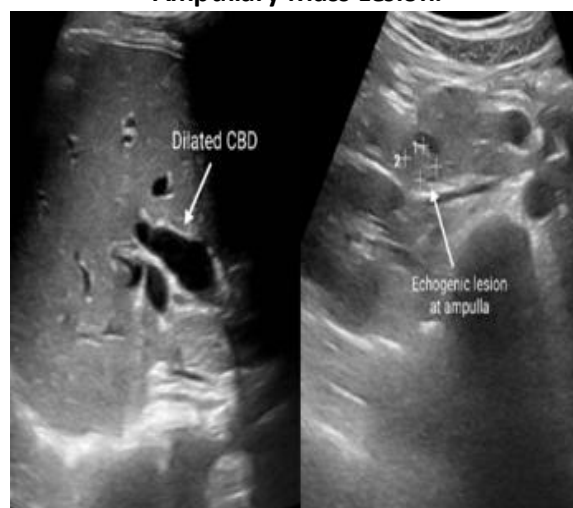
**Table 6: Extrahepatic Biliary Pathologies**

Extrahepatic Biliary Pathologies	NO.
<b>CHD/CBD Calculus</b>	
CHD Calculus	2
Proximal CBD Calculus	1
Mid CBD Calculus	3
Distal CBD Calculus	6
<b>CBD Stricture</b>	
<b>Type</b>	
Smooth Tapering - Benign Stricture	7
Abrupt Cut Off - Malignant Stricture	3
<b>Level</b>	
Proximal	3
Mid	2
Distal	5
<b>Choledochal Cyst</b>	
Type Ia	2
Type Ib	2
Type IVa	1

**Image 5: Dilated RHD And LHD With Calculus In CHD**



**Image 7: Dilated IHBR, CHD And CBD With Echogenic Lesion At Ampulla. Suggesting Ampullary Mass Lesion.**



**Image 6: Fusiform Dilatation Of CBD Along Its Whole Length With Echogenic Sludge. Suggesting Choledochal Cyst.**



**Discussion:** Overall, biliary tract disease is one of the commonest causes of acute abdominal pain admitted to the emergency department. Due to the difficulty in confirming the appropriate diagnosis clinically; ultrasound is the first modality that is commonly used for assessment.

Common biliary system pathologies diagnosed routinely by ultrasound are gallbladder pathologies and biliary tree obstruction. The pathologies of gallbladder can be either benign or malignant. Common benign pathologies are sludge, stones, polyp and adenomyomatosis; while malignant pathologies are uncommon. Gallbladder malignancy usually has asymmetrical wall thickening or intraluminal growth with

internal vascularity. Gallstones are the most common pathology which can be asymptomatic or presents as right upper abdominal/epigastric pain. Increasing age, obesity, female gender and certain ethnicity (i.e. African Americans and Indians) are risk factors for developing gallstones.

In our study most common pathology found was gallstones (47%)(Table 1).On USG gallstones appear as a hyperechoic focus casting posterior acoustic shadowing. Our study showed average size of gallbladder calculus was 7 to 8 mm.USG is the most helpful tool for determining size of calculus and impacted or non impacted calculus which can further help in decision making whether surgical intervention is required or not.

In acute cholecystitis, the gallbladder is usually distended, thick walled, with pericholecystic free fluid and usually probe tenderness is present.

Whereas, in chronic cholecystitis the gallbladder is smaller and contracted than usual, with multiple stones and thick fibrous echogenic wall.

Our study showed that out of 40 patients with gallstones; female gender (73%) has more predilection for having gallstones and its associated complications, i.e. cholecystitis, perforation and malignancy(Table 2) (Table 3).

Gallbladder polyp appears as hyperechoic focus attached to the wall of gallbladder and devoid of any posterior acoustic shadowing. Main difference between gallstone and gallbladder polyp is that the non impacted gallstone generally moves freely into the lumen with patients position; while polyp does not move even after changing the patient's position as its attached to the wall.USG is helpful in determining the size of the polyp, which can be helpful in decision making whether surgical intervention is required or not. In our study 19 % patients had gallbladder polyp.

Gallbladder adenomyomatosis is a benign cause of diffuse or focal gallbladder wall thickening. Mural wall thickening with echogenic intramural foci which emanate comet tail reverberation artefact, suggesting unique acoustic signature of cholesterol crystals in case of adenomyomatosis.

In our study 11 % patients had adenomyomatosis. Patients with obstructive jaundice usually present with yellowish

discoloration. Gallbladder adenomyomatosis and gallbladder polyp usually do not require further investigation for the confirmation of the diagnosis as USG is the confirmative modality for diagnosing both the pathologies. Of skin, abdominal pain associated with vomiting, itching, light colored stool, dark urine and hyperbilirubinemia with deranged SGPT and SGOT levels.

Ultrasound has a distinct role in the diagnosis of patients having obstructive jaundice. Ultrasound is helpful in locating the level and cause of the obstruction. Our study showed commonest pathologies associated with biliary tree dilatation were biliary tree stones(65%). In our study malignant pathology of biliary tree was relatively uncommon.

In patients with excessively gaseous abdomen ultrasound has limitations in diagnosing the level and cause of biliary tree obstruction, however with good bowel preparation and availability of high frequency new generation transducers these difficulties can be easily overcome.

In paediatric patients having choledochal cyst; usual presentation is right upper quadrant abdominal pain and jaundice. Choledochal cyst is usually classified in V types according to todani et al. classification. Our study showed in the paediatric age group (0-16 years) out of total 12 patients, 5 patients had choledochal cyst and common type was type I (Table 6).

USG is very useful modality for the diagnosis of the choledochal cyst which usually does not require further imaging for the confirmation; while gallbladder perforation, malignancy, CBD stricture usually requires confirmation by using further imaging modalities i.e. CT scan or MRCP.

Biliary atresia is a congenital biliary disorder affecting infants. It is characterized by absence or severe deficiency of the extrahepatic biliary tree and the commonest cause of neonatal cholestasis. Usual presentation of atresia is jaundice,dark urine and clay coloured stools. On USG; gallbladder is generally atretic with non visualisation of CBD and echogenic fibrous tissue is visualised anterior to the portal vein giving triangular cord sign. Our study showed 2 infants with jaundice had biliary atresia (Table 1).Biliary atresia usually needs further investigation i.e. nuclear imaging (HIDA scan) for confirmation.

Thus ultrasound is painless, relatively inexpensive and has several advantages over other imaging modalities like CT scan as it does not need contrast material, free from radiation, causes no side-effects and safe during pregnancy.

**Conclusion:** Ultrasound which is a non-invasive, least expensive and highly sensitive imaging modality for the assessment of the gallbladder and biliary tree pathologies especially in emergency situations. It can provide useful information about the presence of GB pathologies such as gallstones, cholecystitis, gallbladder polyps, gallbladder malignancy, perforation and moreover about the site and cause of biliary tract obstruction.

**Abbreviations:** CHD: Common hepatic duct, CBD: Common Bile duct, CT Scan: Computed tomography scan, GB: Gallbladder, HIDA Scan: Hepatobiliary iminodiacetic acid Scan, IHBR: Intrahepatic biliary radicles, MRCP: Magnetic resonance cholangiopancreatography, USG: Ultrasonography.

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