

Ultrasonographic evaluation of gall bladder diseases

Jagadeesh K S^{1*}, Ashwini M Patil²

¹Associate Professor, ²Assistant Professor, Department of Radiology, Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bengaluru, Karnataka, INDIA.

Email: jagadeesh_ks5@yahoo.co.in, drashwini2010@gmail.com

Abstract

Background and Objectives: Ultrasound is simple procedure and its accuracy of detection of gall bladder diseases is very high. To evaluate the role of ultrasound as the primary diagnostic imaging modality in gallbladder diseases. **Materials and Methods:** This study was conducted in Department of Radiology, Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bengaluru, involving 75 cases. Patients suspected to have gallbladder diseases were included in the study. Initial diagnostic imaging method and gall bladder diseases evaluated accordingly. These gallbladder diseases were subjected to ultrasound guided FNAC for confirmation of diagnosis. Later the validity of ultrasound diagnosis in relation to FNAC diagnosis was studied. **Results:** In the present study, 75 cases were involved. Maximum incidence of gallbladder disease seen in the age group of 40-49 years and 69 (92%) of the cases were of gallstone. The total number of chronic cholecystitis was observed in 46 cases, among them 44 cases associated with gallstones and 2 cases were not associated with gallstones. 12 cases of gallstones were not associated with acute or chronic cholecystitis, there are 10 cases with acute cholecystitis. In 68 cases of gallstones, the clinical suspicion was proved correct in 32 cases, while radiology identified them correctly in 69 cases. Acute cholecystitis was correctly diagnosed clinically in 9 cases and by radiological means 10 in a total of 11 cases. Among the 44 cases of chronic cholecystitis, clinical diagnosis was correct in 7 cases and radiological diagnosis was correct in 44 cases. The radiological diagnosis was correct in 69 cases, among 68 cases of gall stones in 10 out of 11 cases with acute cholecystitis in 44 out of 44 cases of chronic cholecystitis, in 5 out of 5 cases of gallbladder carcinoma in 1 out of 1 cases of gallbladder polyp. **Conclusion:** Study suggests that Ultrasound can be used as a primary imaging modality for diagnosis and characterization of gall bladder disease.

Key Words: Gallbladder diseases; Ultrasonography; Fine needle aspiration cytology.

*Address for Correspondence:

Dr. Jagadeesh KS, Associate Professor, Department of Radiology, Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bengaluru, Karnataka, INDIA.

Email: jagadeesh_ks5@yahoo.co.in

Received Date: 16/12/2019 Revised Date: 02/01/2020 Accepted Date: 22/01/2020

DOI: <https://doi.org/10.26611/10131328>

Access this article online

Quick Response Code:



Website:

www.medpulse.in

Accessed Date:
06 February 2020

INTRODUCTION

Ultrasonography is cost effective, quick and less time consuming, freely available, non-invasive and can be easily performed. Ultrasound is simple procedure and its

accuracy of detection of gall bladder diseases is very high.¹ Gallbladder diseases constitute a significant health problem in developed societies, affecting 10% to 15% of the adult population.² Gallbladder diseases are commonly seen in middle aged female population and they are present mostly in the western world.^{3,4} The prevalence of this disease is 10% to 20% of the world population.⁵ The prevalence in India has been reported as 2 to 29% and seven times more common in the north India.⁶ 10% of the adult patients have asymptomatic gall stones. The prevalence varies with age, sex and ethnic group. In developed countries, gallbladder diseases occurs due to formation of cholesterol gallstones and while most of these gallstones are clinically silent, 20% of people harboring stones experience biliary symptoms.⁷ The incidence of gallbladder diseases are more common in

India.⁸ The risk factors of cholesterol gallstone formation are ethnic background, age, female sex, family history and genetic factors. The modifiable risk factors include obesity, rapid weight loss and physical inactivity.² Gallbladder disease is multi-factorial in origin including infections, genetic susceptibility and modifiable lifestyle factors. Of particular note is the significant difference in rates of gallbladder disease by ethnicity/race and geography. The prevalence is highest among Hispanic populations of Central and South American and in individuals with Native American ancestry.⁹ Ultrasonography as a valuable and primary imaging modality helps in initial diagnosis and in different types of gall bladder diseases. Ultrasound has been widely used to diagnose gallbladder diseases.¹⁰ Ultrasound has the best sensitivity and specificity for evaluating patients with suspected gallstones. Gallbladder pathologies include a host of conditions which are seen almost every day in radiology practice and the identification of which helps in bringing down the morbidity and mortality associated with them. The radiological evaluation of gallbladder diseases have undergone an ocean of change with advent of ultrasound in the mid 1970's. What was the golden standard in yesteryears (OCG) is no more a commonly available option due to the better appreciation of gallbladder diseases by ultrasound. Ultrasound techniques on the other hand have found greater acceptance by every faculty overwhelmingly throughout the world with its high degree of sensitivity for nearly the entire spectrum of gallbladder disease.¹¹ The aim of the study is (a) To evaluate the role of ultrasound as the primary diagnostic imaging modality in gallbladder diseases (b) To correlate clinical radiological and Pathological findings in Patients with gallbladder diseases with special reference to ultrasound. (c) Ultrasound evaluation of gallbladder diseases with clinical and pathological findings.

MATERIALS AND METHODS

This study was conducted in Department of Radiology, Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bengaluru, involving 75 cases. The patients were referred to our department from the surgery and Medicine Departments. All the cases presenting with features suggestive of gallbladder diseases were screened

RESULTS

In the present study, 75 cases were involved. Out of 75 cases, there were 25 (33.3%) males and 50 (66.7%) females. Maximum incidence of gallbladder disease seen in the age group of 40-49 years, followed by 50-59 and 60-69 years with 19, 17 and 15 cases respectively (Table 1).

clinically and were followed prospectively through their investigation and management options as per the proforma appended. Patients in whom the conditions were incidental were also included. All cases were examined and investigated during their stay in the hospital. Symptomatic patients with positive ultrasound findings, asymptomatic patients with gall bladder diseases diagnosed on ultrasound with pathological confirmation, symptomatic patients with gallbladder lesions were included in this study. A detailed history was taken with special reference to the symptoms of gallbladder as described in the succeeding proforma. The patients were examined thoroughly in the natural light which included general examination and systemic examination involving all the systems and right upper quadrant in detail. Ultrasound was done in all the cases to confirm or to exclude the gallbladder diseases. Cases taken for surgery were included early when pathological specimens were available. In the present study, gray scale real time ultrasound examination was carried out using 3.5 to 10 MHz curvilinear and linear array transducers at Akash Institute of Medical Sciences and Research Centre, Devanahalli, Bengaluru, using the instruments GE VOLUSON P8 and Samsung U50 Ultrasound scan machines. The examinations were performed with patients in supine and left lateral positions. Other positions like sitting and right lateral were utilized wherever necessary. The transducers were placed in the region of right axillary line in a subcostal or low intercostal position. The optimal degree of inspiration was enforced to yield the best visualization of gallbladder. The entire gallbladder was scanned in its long and short axis and the morphology of gallbladder, presence of any pathology were particularly looked for. In addition, the bile ducts, liver and the rest of adjacent areas were also examined for the evidence of any associated pathology, whenever required patients were called for re-examination. The referring clinicians were contacted for follow-up especially with regards to the management through their surgeries. The pathology reports were reviewed on 75 patients who either underwent cholecystectomy or in whom materials were available for pathological evaluation. FNAC was done under ultrasound guidance.

Table 1: Age and Sex Wise Distribution of Incidence of Gallbladder Disease

Age group (years)	Male		Female		Total	
	No.	Percent	No.	Percent	No.	Percent
≤ 19	01	1.30	00	0.00	01	1.30
20 - 29	01	1.30	05	6.60	06	7.90
30 - 39	03	4.00	06	8.00	09	12.00
40 - 49	07	9.30	12	16.00	19	25.30
50 - 59	06	8.00	11	14.70	17	22.70
60 - 69	04	5.40	11	14.70	15	20.10
70 - 79	02	2.70	03	4.00	05	6.70
≥80	01	1.30	02	2.70	03	4.00
Total	25	33.30	50	66.70	75	100.00

In the present study, out of 75 cases of gallbladder diseases, 69 (92%) of the cases were of gallstone. Out of these 69 cases of gallstones, 20 (29%) were males and 49 (71%) were females. Maximum number of cases were seen in the 4th and 5th decade of life (Table 2 and Figure 1 and 2).

Table 2: Incidence of gallstones with age and sex

Age group (years)	Male		Female		Total	
	No.	Percent	No.	Percent	No.	Percent
≤19	01	1.50	00	0.00	01	1.50
20 - 29	01	1.50	05	7.30	06	8.80
30 - 39	03	4.30	06	8.70	09	13.00
40 - 49	05	7.20	11	15.90	16	23.10
50 - 59	05	7.20	11	15.90	16	23.10
60 - 69	02	2.90	11	15.90	13	18.80
70 - 79	02	2.90	03	4.40	05	7.30
≥80	01	1.50	02	2.90	03	4.40
Total	20	29.00	49	71.00	69	100.00

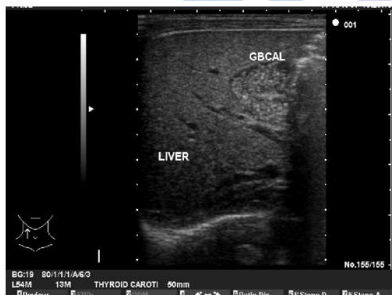


Figure 1: Gallbladder calculus



Figure 2: Gallbladder mass

The total number of chronic cholecystitis was observed in 46 cases, among whom 44 cases were associated with gallstones and 2 cases were not associated with gallstones. 12 cases of gallstones were not associated with acute or chronic cholecystitis, there are 10 acute cholecystitic cases observed in the present study with a male to female ratio of 1:2 (Table 3, Figure 3).

Table 3: Incidence of gallstones in acute and chronic cholecystitis with age and sex

Age group (years)	Male		Female		Total	
	Acute Cholecystitis	Chronic Cholecystitis	Acute Cholecystitis	Chronic Cholecystitis	Acute Cholecystitis	Chronic Cholecystitis
≤ 19	01	00	00	00	01	00
20 - 29	00	01	01	04	01	05
30 - 39	01	01	01	02	02	03
40 - 49	00	05	01	07	01	12
50 - 59	01	02	02	08	03	10
60 - 69	00	02	03	05	03	07
70 - 79	00	02	00	02	00	04
≥ 80	00	01	00	02	00	03
Total	03	14	08	30	11	44



Figure 3: Pericholecystic edema

Clinical and Radiological Diagnosis in Gall Bladder Diseases:

In 68 cases of gallstones, the clinical suspicion was proved correct in 32 cases, while radiology identified them correctly in 69 cases. Acute cholecystitis was correctly diagnosed clinically in 9 cases and by radiological means 10 in a total of 11 cases. Among the 44 cases of chronic cholecystitis, clinical diagnosis was correct in 7 cases and radiological diagnosis was correct in 44 cases. Among the other 6 cases that include cases of polyps and malignancies, the diagnosis was correct in 2 cases, clinically and 4 cases radiologically (Table 4).

Table 4: Clinical and Radiological Diagnosis in Gallbladder Diseases

Condition	Clinical	Radiological	Actual
Gallstone	32 (42.66%)	69 (92.0%)	68 (90.66%)
Acute cholecystitis	9 (12.00%)	10 (13.33%)	11 (14.66%)
Chronic cholecystitis	7 (9.33%)	44 (58.66%)	44 (58.66%)
Others	2 (2.66%)	4 (5.33%)	7 (9.33%)

Radiological versus Pathological Diagnosis in Gallbladder Diseases:

The radiological diagnosis was correct in 69 cases, among 68 cases of gall stones in 10 out of 11 cases with acute cholecystitis in 44 out of 44 cases of chronic cholecystitis, in 5 out of 5 cases of gallbladder carcinoma in 1 out of 1 cases of gallbladder polyp (Table 5).

Table 5: Radiological Vs pathological diagnosis of gallbladder diseases

Condition	Radiology	Pathology	Actual
Gallstone	69 (92.0%)	50 (66.6%)	68 (90.6%)
Acute cholecystitis	10 (13.3%)	9 (12.0%)	11 (14.6%)
Chronic cholecystitis	44 (58.6%)	11 (14.6%)	44 (58.6%)
Carcinoma	4 (5.3%)	4 (5.3%)	4 (5.3%)

DISCUSSION

Gallbladder diseases are very common entities with diverse features of presentation at clinical, radiological and pathological settings with variable morbidity and mortality. It implies an altered hepatobiliary function. Majority of gallbladder diseases involves gallstones, which form about 95% of the all gallbladder diseases and

non-calculus disease form about 5%. Acute or chronic inflammations of gallbladder, commonly seen in association with calculus gallbladders. Benign neoplasms are very rare, whereas malignant neoplasms are more common than benign neoplasms but uncommon compared to inflammatory conditions.^{12, 13} In the present study, 69 cases were of calculus disease and 5 were non-calculus. Among them one had a cholesterol polyp, and other 4 were carcinoma of gallbladder. The ultrasound criteria used for the diagnosis of the gallstones were based upon the ultrasound classification of stones. Type-I stones were seen in 63 cases. Type-II in 2 cases and type-III in 2 cases. Two stone was missed on ultrasound. In our study, the gallbladder diseases were seen in the age group ranging from 15 years to 80 years. Majority of the cases occurred from 40 to 69 years (72%), with a peak at 4th and 5th decade (54%). From this peak the incidence was found to be decreasing with both increasing and decreasing age groups. There were 25 (33.31%) men and 50 (66.71%) women in a total of 75 cases, with male-female ratio of 1:2. The incidence of gallstones in our study was 92% (69 out of 75). The age group ranged from 15 years to 80 years. The maximum number of cases (33) was seen in from 40-69 years (72%), with peak incidence in the fourth and fifth decades (52%). Gallstones were seen in 28% (20 out of 69) men and 71% (49 out of 69) women with a male-female ratio of 1:2. In our study the M-F ratio, below 40 years was 1:3 and male to female ratio above 40 years was 1:2. Men were predominantly affected in their, fourth and fifth decades while women were affected predominantly in the fourth, fifth and sixth decades. None of the women affected were below 20 year and none of the men were affected above 80 years. Age and female sex have repeatedly been identified as determinants of gallstone formation in cohort studies. The majority of previous cohort studies have not explored the effects of changes with age in physiology, lifestyle, or reproductive hormones and, further, it is less known what determines the sex differences in gallstone formation.^{14, 15} Aging during adulthood has been associated to a number of physiological changes such as atherosclerosis, decline in male sex testosterone level, and a decline in estrogen levels in women which all have been associated with cardiovascular disease and overall mortality.¹⁶ Changes in lifestyle with advancing age such as the cessation of tobacco smoking has also shown to significantly alter cardiovascular, cancer, and mortality risk in cohort studies.¹⁷ Gallstones are associated to cardiovascular mortality and associations with cardiovascular disease risk factors have also been identified.^{18,14} An exploration of changes with age in cardiovascular risk factors and sex differences is therefore reasonable and would provide knowledge about gallstone

disease and prevention.¹⁵ Since gallstones form majority of gallbladder diseases the incidence of them more often closely follows that of the gallstones. Gallstones were associated with 11 cases of acute cholecystitis (22%) and 44 cases of chronic cholecystitis (98%). One case of gallstone was neither associated with acute or chronic cholecystitis. Acute cholecystitis in association with gallstones was seen in one case in men and in 9 cases in women. The single case of acute cholecystitis in male was seen in a 15 year, old boy. Among the nine cases of acute cholecystitis seen in female six cases were seen in third, fifth and sixth decades. In both the sexes, 70% of cases of gallstones associated with acute cholecystitis were seen in third, fifth and sixth decades. Acute cholecystitis inflammation of the gall bladder-is most often caused by gall stones. Gall stones are one of the most common disorders of the gastrointestinal tract. More than 80% of people with gall stones are asymptomatic. Acute cholecystitis develops in 1-3% of patients with symptomatic gall stones.^{19,20} Over 90% of cases of acute cholecystitis result from obstruction of the cystic duct by gall stones or by biliary sludge that has become impacted at the neck of the gall bladder. Obstruction of the cystic duct causes the intra-luminal pressure within the gall bladder to increase and, together with cholesterol supersaturated bile, triggers an acute inflammatory response. The trauma caused by the gall stones stimulates the synthesis of prostaglandins I₂ and E₂, which mediate the inflammatory response.¹⁹

There were totally 14 cases of chronic cholecystitis in men and 30 cases in women, associated with gallstones. The distribution of majority (77%) of the cases of chronic cholecystitis was encountered in fourth, fifth and sixth decades. In men 80% of the cases were in fourth and fifth decades. In women, majority of the cases (76%) were encountered in fourth, fifth and sixth decades. Chronic cholecystitis, a common form of gallbladder (GB) inflammation that is usually associated with gallstones, is one of the most prevalent diseases requiring surgical intervention. Chronic GB inflammation gives rise to effects such as thickening of the GB wall and GB contraction.²¹ Although GB wall thickening can be due to various conditions, chronic GB inflammation is known to lead to thickening of the GB wall. When a GB is chronically contracted, it is regarded to be a result of long-standing chronic cholecystitis.²² Chronic cholecystitis is typically diagnosed by ultrasonography and computed tomography (CT) based on a distended or contracted GB and the absence of pericholecystic inflammatory stranding or fluid.²³ Imaging studies usually reveal diffuse thickening of the GB wall; however, thickening is sometimes localized to a focal portion of the wall.²⁴ Chronic cholecystitis almost always occurs in the

setting of the cholelithiasis, and it is accompanied by GB wall thickening in many cases.²⁵ Increased thickness of the GB wall is also a sign of significant inflammatory change.²⁶ Contraction of GB is known to result from long-standing chronic cholecystitis. Moreover, chronic inflammation of the GB leads not only to radiologic anatomic changes, but also to various histologic changes of the GB wall, including fibrosis, hyperplasia, dysplasia, and metaplasia.^{27, 28} Several reports have shown that a lot of GB cancer patients have a history suggestive of chronic cholecystitis.^{29, 30}

Clinical V/s Radiological Diagnosis in Gallbladder Diseases

In 68 cases of gallstones, the clinical suspicion was proved correct in 32 cases, while radiology identified them correctly in 69 cases. Acute cholecystitis was correctly diagnosed clinically in 9 cases and by radiological means 10 in a total of 11 cases. Among the 44 cases of chronic cholecystitis, clinical diagnosis was correct in 7 cases and radiological diagnosis was correct in 44 cases. Among the other 6 cases that include cases of polyps and malignancies, the diagnosis was correct in 2 cases, clinically and 4-cases radiologically.

Radiological versus Pathological Diagnosis in Gallbladder Diseases

The radiological diagnosis was correct in 69 cases, among 68 cases of gall stones in 10 out of 11 cases with acute cholecystitis in 44 out of 44 cases of chronic cholecystitis, in 5 out of 5 cases of gallbladder carcinoma in 1 out of 1 cases of gallbladder polyp.

CONCLUSION

Ultrasound is a safe and effective method of detecting gallbladder disease. Its flexibility, easy availability and lack of dependence on organ function makes it most ideal for imaging gallbladder diseases. The ultrasonography when adopted as an initial imaging modality was seen as a method, which reduced the cost and time to arrive at a diagnosis. Ultrasonography is highly sensitive in diagnosing gallbladder diseases such as gall stones, acute cholecystitis, chronic cholecystitis, benign and malignant gall bladder diseases, which constituted majority of gall bladder diseases in the present study. Despite the minimum drawback, it is evident from this study that ultrasonography has a wide applicability in the diagnosis of gallbladder diseases.

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Source of Support: None Declared
Conflict of Interest: None Declared