

Comparative Study of Ultrasonographic Findings with the Operative Findings of Biliary Surgery - A Study of 100 Cases

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ABSTRACT

Background & objective: Ultrasonography (USG) of gallbladder and biliary system has become the primary imaging modality for the diagnoses of pathologies there. However, its accuracy in the diagnosis of various pathologies of gallbladder and biliary system is still debated. The present study was undertaken to determine the accuracies of USG in the diagnosis of various pathologies of biliary system and associated structures.

Methods: This descriptive cross-section study was conducted in the Department of Surgery, Sir Salimullah Medical College and Mitford Hospital (SSMC&MH), Dhaka, between February 2002 to January 2003. Patients with symptoms and signs related to biliary disease and supposed to requiring some form of biliary surgery were included in this study. Patients having chronic liver diseases were excluded from the study. A total 100 subjects were included. On obtaining ethical clearance from the Ethical Committee of Sir Salimullah Medical College and Mitford Hospital (SSMC&MH), Dhaka, data collection was commenced. All the sampled population were subjected to USG of whole abdomen followed by laparotomy/operative treatment. Peroperative diagnosis was taken as confirmatory diagnosis, against which accuracy of USG was evaluated.

Result: The study revealed that biliary disease was common in the fourth decade of life and females were more often affected than the males (female-to-male ratio: 3:1). Pain the right hypochondriac region was the most common (93%) presenting symptom, which in most cases (74%) was associated with flatulent dyspepsia. In over half (54%) of the cases, the pain increased after fatty meal. Right hypochondriac tenderness was the predominant physical sign (40%) followed by clinical jaundice (15%). Gallbladder and liver were palpable in few cases. Mild to moderate anaemia was observed in majority (82%) of the cases and severe anaemia (Hb < 50%) in 3% cases. Majority (85%) had leucocyte count within normal range (8,000-11,000/cu-mm of blood). Fifteen percent patients had significant rise of serum bilirubin (> 10 mg/dl); of them two had serum bilirubin > 20 mg/dl with a diagnosis of carcinoma head of the pancreas and/or gallbladder. Ultrasonography diagnosed 4 cases as having choledocholithiasis. But 6 more cases of choledocholithiasis were detected during operation with a false positive rate being 49.4%. Gallstone was reported to have been present in 78 patients by USG; 76 of them were confirmed peroperatively. Sensitivity and specificity of USG for common bile duct stone in this study was 4% and 90% respectively.

Conclusion: The sensitivity of USG in the diagnosis of gall-stone was found to be optimum and moderate in the diagnosis of cholecystitis. In the diagnoses of other pathologies of biliary system, its sensitivity is much lower. Neoplastic lesion of pancreas and soft tissue mass inside common bile duct are too difficult to diagnose by USG. However, its specificity in ruling out the diagnosis of gall-stone is extremely low, but appreciably high in excluding other pathologies of biliary system.

Key Words: Ultrasonographic diagnosis, operative findings, biliary surgery, biliary pathology etc.

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INTRODUCTION:

Biliary surgery is heading the list of routine surgical operations in Bangladesh. For proper management of patients, preoperative specific diagnosis is essential. Ultrasonography (USG) of gallbladder as the primary imaging modality, has essentially replaced oral cholecystography as the examination of choice for detecting cholelithiasis. Furthermore, ultrasonography detects gallstones that are not visualized on oral cholecystography.^{1,2} Intravenous cholangiography (IVC), on the other hand, though can be done rapidly, is less accurate method with 12 percent false positive and 17 percent false negative results³. Endoscopic retrograde cholangio-pancreatography (ERCP) is again an invasive and relatively costly procedure, although, it is highly accurate in demonstrating diseases of extrahepatic biliary tree. Ultrasonography, which has been introduced in the country in September, 1980, a noninvasive diagnostic tool with no radiation hazard has well been flourishing rapidly as a preliminary and primary investigation, accepted by both surgeons and patients. It has accuracy in diagnosing pathologies of hepatic and extrahepatic biliary tree and has no contraindication.⁴ Particularly, patients with hyperbilirubinaemia, where OCG/IVC is useless, can well be evaluated by USG. Other investigations like biliary manometry, computed tomography (CT) scan, magnetic resonance cholangio-pancreatography (MRCP) etc. can be supplementary, but USG alone is unique if availability and cost-effectiveness is considered.

Gallstones appear as high-level bright structures due to the total reflection and absorption of ultrasound beam, which produce characteristic posterior acoustic shadows.⁵ If not impacted in the neck or wall of the gallbladder, stones always change its position with the changing position of the patients.^{5,6} Gallstones are often associated with cholecystitis where wall of the gallbladder become thickened.⁷ Cholelithiasis is also associated with non-functioning gallbladder which appears as a distended gallbladder. Sludge-like intraluminal echoes can be a source of confusion. Both pus and blood with the gallbladder lumen can appear identical to biliary sludge. Tumefactive sludge also may cause diagnostic difficulty because it can resemble either soft pigment stones or an

intraluminal mass.⁸ Gallbladder wall thickening is usually categorized as diffuse or focal. Occasionally, however, focal gallbladder wall changes occur in patients who do not have gallbladder disease. Oedema localized to gallbladder fossa may erroneously diagnosed as gallbladder wall thickening.

Ultrasonography is a non-invasive and safe diagnostic modality for the diagnosis of choledochal cyst and could be considered as the primary module for detection of pancreatic disease. Diagnosis of acute and chronic pancreatitis along with pancreatic calcification and calculi in the main pancreatic duct has been easier with ultrasonography. Pancreatic calculi can be better delineated whether the calculi are in the main pancreatic duct or in the pancreatic parenchyma. With spreading availability, surgeons at all levels in Bangladesh are increasingly depending on it. However, its sensitivity and specificity depend much on the experience of sonologists and therefore, requires an experienced operator to maximize its accuracy in diagnosis. Besides, ultrasonogram itself is not 100 percent sensitive in diagnosing biliary disease. Fault and fallacies remain with its detection. Negative ultrasonographic finding for stone are at times negated by cholecystogram or others at operation. Comment on status of gallbladder wall, presence or absence of biliary sludge, presence or absence of soft tissue mass inside gallbladder or bile ducts are at times misinterpreted. However, few studies have so far been done in the country concentrating on its accuracy in detecting biliary pathologies. The present study was done to nib into its accuracy in delineating biliary surgical diseases compared to operative findings.

METHODS:

This descriptive cross-sectional study was conducted in the Department of Surgery, Sir Salimullah Medical College and Mitford Hospital (SSMC & MH), Dhaka, between February 2002 to January 2003. Patients with symptoms and signs related to biliary disease and supposed to requiring some form of biliary surgery were included in the study. Patients having chronic liver diseases were excluded from the study. A total 100 subjects were included. On obtaining ethical clearance from the Ethical Committee of Sir Salimullah Medical College and Mitford Hospital

(SSMC & MH), Dhaka, data collection was commenced. All the sampled population were subjected to USG of whole abdomen. Laparotomy or operative surgery was done and peroperative diagnosis was taken as confirmatory diagnosis, against which USG diagnosis was compared to find its accuracy in detecting biliary pathologies. Data processing and analysis were done using SPSS (statistical package for social sciences), version 17. The test statistics used to analyze the data were descriptive statistics and accuracy (sensitivity, specificity, positive and negative predictive values) test.

RESULTS:

The age of the patients studied in the series varied from 11 to 68 years. The highest incidence (52%) was in the fourth decade of life and very few were found above 50 years of age. A female predominance was observed in the series with female-male ratio being roughly 3:1. Over one-third (34%) of the patients was overweight and obese (Table I).

Table II shows the mode of clinical presentation of the patients. Majority of the patients complained of pain in the hypochondrium (93%) with radiation of pain to back or shoulder in 50% cases. Dyspepsia was the second-most common complaint (74%) followed by fatty food intolerance (54%), nausea/vomiting (40%), fever (20%) and anorexia (19%). Some patients (17%) however had pain in the epigastric region. The most common sign was tenderness in the right hypochondrium (40%) followed by jaundice (15%), positive Murphy's sign (5%) and palpable gall-bladder (5%). Majority (85%) of the patients was anaemic with 3 having severe anaemia (Hb<50%). Fifteen percent patients exhibited high leucocyte count (> 11000/cu-mm). One patient with severe cholangitis had a very high count (16,500/cu-mm). Serum bilirubin was high (≥ 2 mg/dl) in 15% cases. Of them two patients had serum bilirubin > 20 mg/dl. These cases had carcinoma head of the pancreas or gallbladder or choledocholithiasis (Table III).

No major differences on USG and laparotomy diagnoses of biliary pathologies were observed, except in the diagnosis of stone inside common bile ducts (choledocholithiasis). USG underdiagnosed

choledocholithiasis than that diagnosed by laparotomy (4% vs. 10%, $p=0.096$) (table IV). USG findings did not grossly mis-match with operative findings except inflammatory adhesions of gall bladder and biliary pancreatitis. While 9% patients exhibited adhesions, none of them was preoperatively diagnosed as having adhesion by USG ($p=0.002$). Likewise, 3% patients were diagnosed as having evidence of biliary pancreatitis, although none of them was diagnosed beforehand ($p=0.123$) (Table V).

The different components of accuracy of USG in the diagnoses of biliary pathologies are illustrated in table VI. The highest sensitivity of USG was found in the diagnosis of gall-stone (78%) followed by thickening of gallbladder wall with contracted gallbladder (52%). In the diagnoses of other pathologies of biliary system, its sensitivity is inappreciably lower. Neoplastic lesion of pancreas (adenocarcinoma) and soft tissue mass inside common bile duct were not at all diagnosed by USG. However, its specificity in excluding the diagnosis of gall-stone is extremely low, but appreciably high in excluding other pathologies biliary system. Positive and negative predictive values (PPVs and NPVs) of the test was however, moderate, except the PPVs in the diagnoses of neoplastic lesions of pancreas and soft tissue mass inside common bile duct. The false positive and false negative rates were also found to be moderate except the in the diagnoses of neoplastic lesions of pancreas and soft tissue mass inside common bile duct, the false positive yield of which was 100%.

Table I. Distribution of the patients by their demographic characteristics (n = 100)

Demographic characteristics	Frequency	Percentage
Age (years)		
≤ 20	28	28.0
31 – 40	52	52.0
41 – 50	12	12.0
> 50	8	8.0
Sex		
Female	76	76.0
Male	24	24.0
Overweight & obesity		
Present	34	34.0
Absent	66	66.0

Mean age : 13.8 ± 1.4 years; range : 11 – 68 years.

Table II. Distribution of patients by presenting clinical features (n = 100)

Clinical features symptoms/signs	Frequency	Percentage
Symptoms		
Pain in the right hypochondrium	93	93.0
Pain in the epigastrium	17	17.0
Dyspepsia	74	74.0
Fatty food intolerance	54	54.0
Radiation of pain to back/shoulder	50	50.0
Nausea/vomiting	40	40.0
Fever	20	20.0
Anorexia	19	19.0
History of jaundice	08	8.0
Signs		
Tenderness in right hypochondrium	40	40.0
Jaundiced	15	15.0
Murphy's sign positive	05	5.0
Boas' sign positive	01	1.0
Palpable gallbladder	05	5.0
Palpable liver	01	1.0

Table III. Distribution of the respondents by investigation findings (n = 100)

Investigations	Frequency	Percentage
Haemoglobin (%)		
< 50	03	3.0
50 – 70	82	82.0
70 – 80	10	10.0
> 80	05	5.0
Leucocyte count (per cu-mm)		
≤ 11,000	85	85.0
> 11,000	15	15.0
Serum bilirubin (mg/dl)		
<1	80	80.0
1-2	05	5.0
2-20	13	13.0
>20	02	2.0

Table IV. Comparison between USG and laparotomy diagnoses of biliary pathologies

Findings	Diagnostic modalities		p-value
	USG	Laparotomy	
Gallstones	78(78.0)	76(76.0)	0.737*
Stones inside common bile ducts	4(4.0)	10(10.0)	0.096*
Stones in cystic duct	3(3.0)	3(3.0)	1.000*
Soft tissue mass inside gallbladder	1(1.0)	3(3.0)	0.311**
Neoplastic lesion of pancreas (adenocarcinoma)	0(0.0)	2(2.0)	0.249**
Soft tissue mass inside common bile duct	0(0.0)	1(1.0)	0.500**
Dilatation of biliary tree (mostly extrahepatic)	13(13.0)	15(15.0)	0.684*
intrahepatic biliary dilatation	2(2.0)	1(1.0)	0.500**
Thickening of gallbladder wall with contracted gallbladder	52(52.0)	48(48.0)	0.572*

Figures in the parentheses indicate corresponding %; *Chi-squared Test (χ^2) was done to analyze the data. **Fisher's Exact Test was done to analyze the data.

Table V. Comparison between USG and operative findings

Operative findings of important features	Diagnostic modalities		p-value
	USG	Operative	
Evidence of chronic cholecystitis	55(55.0)	52(52.0)	0.671*
Presence of sludge inside gallbladder	11(11.0)	15(15.0)	0.400*
Evidence of biliary pancreatitis	0 (0.0)	3(3.0)	0.123**
Inflammatory adhesions of gallbladder	0 (0.0)	9(9.0)	0.002**
Infiltrative neoplastic lesion of gallbladder	0 (0.0)	1(1.0)	0.500**

Figures in the parentheses indicate corresponding %; *Chi-squared Test (χ^2) was done to analyze the data. **Fisher's Exact Test was done to analyze the data.

Table VI. Components of accuracy test and their findings

Diseases or pathologies	Accuracy components					
	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	False+ve (%)	False-ve (%)
Gallstones	78.0	24.0	50.6	52.2	49.4	47.8
Stones inside common bile ducts	4.0	90.0	28.6	48.4	71.4	51.6
Stones in cystic duct	3.0	97.0	50.0	50.0	50.0	50.0
Soft tissue mass inside gallbladder	1.0	97.0	25.0	49.5	75.0	50.5
Neoplastic lesion of pancreas (adenocarcinoma)	0.0	98.0	0.0	49.5	100.0	50.5
Soft tissue mass inside common bile duct	0.0	99.0	0.0	49.7	100.0	50.3
Dilatation of biliary tree (mostly extrahepatic)	13.0	85.0	46.4	49.4	53.6	50.6
Intrahepatic biliary dilatation	2.0	99.0	66.7	50.3	33.3	49.7
Thickening of gallbladder wall with contracted gallbladder	52.0	52.0	52.0	52.0	48.0	48.0

DISCUSSION:

Biliary surgery is heading the list of routine surgical performance in our country. Oral cholecystogram and invasive techniques like PTC or IVC were the aids in diagnosing these diseases until two decades ago. With the introduction of ultrasonogram with its wide availability in the country, it has almost replaced them and has become the primary investigation of choice in searching biliary diseases.

The present study was performed to determine the sensitivity of the procedure as a diagnostic tool for biliary pathologies. The study revealed that biliary disease is common in the fourth decade of life, which is consistent with findings of a similar study⁹. A female preponderance was observed in the series with female-male ratio being 3:1. While Person¹⁰ showed a lower female-to-male ratio (2:1), Wahab¹¹ showed a higher ratio of nearly 5:1.

Pain the right hypochondriac region was the most common (93%) presenting symptom in this study which compares well with the findings of Huber et al.⁹ and Burnett et al.¹² The pain was associated with flatulent dyspepsia (74%). While Huber and associates⁹ reported overall incidence of dyspepsia to be about 57%, Singh¹³ reported it to be 53%. In the present series, in 54% of the cases, the pain increased after fatty meal. This is in line with the findings of Singh et al.¹³, who found it at 45.6%. However, it shows a sharp contrast with the study of Huber et al.⁹ who reported fatty-food intolerance to be 13%. In the present series, 17% of the cases presented with pain in the epigastrium, which is usually misdiagnosed as chronic duodenal ulcer and is treated as such. Right hypochondriac tenderness was the predominant physical finding (40%) followed by clinical jaundice (15%). Gallbladder and liver were palpable in few cases. Mild to moderate anaemia was observed in majority (82%) of the cases and severe anaemia (Hb < 50%) was found in 3% cases. Majority (85%) had leucocyte count within normal range (8,000-11,000/cu-mm of blood). Only one patient had significant leucocytosis (16,500/cu-mm of blood) and was diagnosed as cholangitis and managed conservatively. Fifteen percent patients had significant rise of serum bilirubin (> 10 mg/dl); of them two had serum bilirubin > 20 mg/dl. The later

cases had carcinoma head of the pancreas and/or gallbladder.

Ultrasonography diagnosed 4 cases as having choledocholithiasis. But 6 more cases of choledocholithiasis were discovered during operation indicating that USG is not a good diagnostic test to rule out choledocholithiasis with a higher false positive rate (49.4%). However, in all the 10 cases, there were some elevations of alkaline phosphatase. Though none of the 2 cases of carcinoma of the head of the pancreas could be detected by ultrasonogram except dilatation of the common bile duct. In both the cases, serum alkaline phosphatase was elevated. Therefore, it is important to be borne in mind that demonstration of a normal common bile duct by abdominal ultrasound and normal serum alkaline phosphatase together have 100% specificity in excluding bile duct stones.¹⁴ Gallstone was reported to have been present in 78% cases by USG; 76 of them were confirmed peroperatively. In a study done by Islame¹⁵ in 1981, there was 65.2% concordance in the USG diagnosis of gall-stone. Rahman et al.¹⁶ in 1991 found a high sensitivity (98.7%) but a low specificity (26.3%). Anderson and Harned¹⁷ reported 95% specificity, whereas Bartrum et al.¹⁸ observed 99% specificity.

Sensitivity of USG for common bile duct stone in this study was 4%, false negative rate detection was 51.6%. In a similar study by Rahman et al.¹⁶, none of the 7 cases could be diagnosed preoperatively. But in another study¹⁹ it appeared as 84.2% accurate. Ultrasonographic accuracy in commenting about the presence of cholecystitis (thickened gallbladder wall) was 52%. False positive result 48%. In the study of Rahman et al.¹⁰, the sensitivity was shown to be 72%. In another study¹⁹, it appeared 97%. Biliary dilatation was another entity which USG could detect in 13% cases. Two cases of gallbladder ascariasis were diagnosed by USG (not shown in the result). One got admitted as emergency, the other was diagnosed along with gallstone. In the first case USG clearly demonstrated a linear movable structure within gallbladder. After an initial conservative trial failure, laparotomy was done but on operation, no worm was found to be present. In the second case a dead worm was found in the cholecystectomy

specimen and choledochotomy revealed another dead worm from common bile duct. So, the sensitivity for gallbladder ascariasis was 50%. The cause of not finding worm in the first case might be that the worm went down into gut or the worm was actually inside duodenum, whose shadow was superimposed on gallbladder.²⁰ Before concluding the findings of the study, the following limitations of the study deserve mention.

LIMITATIONS:

1. The study was limited to patients who underwent mostly elective surgery for biliary diseases.
2. The study was conducted on a small sample and, as such, caution is advised to generalize the findings to reference population.

CONCLUSION:

The highest sensitivity of USG was found in the diagnosis of gall-stone followed by cholecystitis. In the diagnoses of other pathologies of biliary system, its sensitivity is inappreciably lower. Neoplastic lesion of pancreas (adenocarcinoma) and soft tissue mass inside common bile duct are difficult to diagnose by USG. However, its specificity in excluding the diagnosis of gall-stone is extremely low, but appreciably high in excluding other pathologies of biliary system.

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