

ORIGINAL RESEARCH

Diagnostic efficacy of ultrasonography against magnetic resonance cholangiopancreatography in obstructive biliopathy

¹Dr. Biplab Debbarma, ²Dr. Chandini Reang, ³Dr. Kaushik Tripura

¹Associate Professor, ²Assistant Professor, Department of Radio-Diagnosis, Tripura Medical College and Dr. B.R.Ambedkar Memorial Teaching Hospital, Hapania, Agartala, West Tripura, India

³Associate Professor, Department of Community Medicine, Tripura Medical College and Dr. B.R.Ambedkar Memorial Teaching Hospital, Hapania, Agartala, West Tripura, India

Correspondence:

Dr. Biplab Debbarma

Associate Professor, Department of Radio-Diagnosis, Tripura Medical College and Dr. B.R.Ambedkar Memorial Teaching Hospital, Hapania, Agartala, West Tripura, India

ABSTRACT

Introduction: Obstructive jaundice is one of the most frequent symptoms of hepatobiliary disease and caused by various diseases. So, it is mandatory to determine pre-operatively the existence, the nature and level of obstruction because an ill chosen therapeutic approach can be dangerous. MRCP demonstrates details anatomy and pathology of the biliary and pancreatic ducts. Ultrasonography still remains the first imaging modality for obstructive jaundice. Hence, aim of the present study was to evaluate the diagnostic efficacy of ultrasonography (USG) against magnetic resonance cholangiopancreatography (MRCP) in obstructive biliopathy in detection and characterization in patients suspected with pancreatic and biliary system pathologies.

Material and methods: This study was conducted among sixty patients suffering from obstructive jaundice of all age groups. All the patients in the study underwent ultrasonography and MRCP. The result so obtained was expressed as percentages and variables as required.

Results: In our study, the most common cause of obstructive jaundice was common bile duct stones (55%) followed by tumors (22%) then benign strictures (7%), choledochal cyst (7%), chronic pancreatitis with pseudocysts (7%) and Mirizzi syndrome (3.33%). Diagnostic accuracy of ultrasound in obstructive jaundice taking MRCP findings as gold standard revealed sensitivity, specificity and diagnostic accuracy in benign cases as 97%, 67% and 97.4% and in malignant cases as 86%, 100% and 87.5% respectively.

Conclusion: USG has a high potential efficacy in diagnosing causes of obstructive jaundice. So, it is considered as an initial screening modality to confirm or exclude biliary dilatation & to choose patients for MRCP examination.

Keywords: Ultrasonography (USG), Obstructive Jaundice, Hepato-biliary pathologies, Pancreatic Pathologies, Magnetic Resonance Cholangiopancreatography (MRCP).

INTRODUCTION

Obstructive Jaundice has been considered as one of the leading causes of increased morbidity. Any blockage in the hepatobiliary pathway which obstructs the flow of bile into the intestine, as a result passage of bile into the circulation occurs which leads to symptoms like jaundice and pruritis.^[1]Laboratory investigations like increased serum conjugated bilirubin (>3 mg/dL) and alkaline phosphatase (ALP) help in the diagnosis of obstructive

jaundice. It can cause problems in diagnosis and management, particularly intrahepatic cholestasis. So, it is mandatory to determine the existence, the nature and site of obstruction pre-operatively because an ill chosen therapeutic approach can be dangerous. Ultrasound is used as a screening modality to confirm or exclude biliary duct obstruction, which it does with at least 90% accuracy.^[2]

However, USG is operator dependent and has a limitation in obese patients and those with excessive amount of bowel gas. Magnetic Resonance Cholangiopancreatography has revolutionized the imaging of Hepato-biliary and pancreatic ducts and has emerged as an accurate, noninvasive means of visualization of the biliary tree and pancreatic duct without contrast material.^[3]

MRCP demonstrates the entire biliary tract and pancreatic duct without any intervention, ionizing radiation and use of oral or IV contrast. No post procedural complications are seen, so it can be performed in critically ill patients. The quality of obtained MRCP images is comparable with ERCP, which is considered as standard of reference in biliary and pancreatic ductal pathologies.^[4] The diagnostic accuracy of MRCP suggests that, it has the potential to replace the invasive procedures like diagnostic ERCP, which should be used only in cases where intervention is being contemplated. It has proved effective in demonstrating bile duct dilatation, stricture and CBD stone. In patients with malignant obstruction, this noninvasive imaging technique demonstrates the site and extent of the stricture or stenosis, the degree of dilatation, the presence and size of biliary stones, and associated findings.^[5]

The principle of MRCP is based on heavily T2 weighted fast spin echo sequences. As a result, stationary or slow moving fluid which is present in biliary & pancreatic duct gives high signal intensity, while solid organs have low signal intensity. On these images, the fluid of the biliary and pancreatic ducts gives the cholangiogram and pancreatogram.^[6,7]

MRCP plays a major role in the overall evaluation of biliary & pancreatic duct lesions and modality is expected to provide detailed information that will help identify the nature of the disease. MRCP also provide the location and extents of involvement, type of pathology and guide in biopsy and drainage procedures, indicate method of therapy (medical and/or surgical), suggest surgical approach and help assess response to the therapy.

ERCP is an invasive technique and considered as Gold standard in the evaluation of biliary pathway, but it has few complications like pancreatitis. The quality of MRCP images is comparable with that of direct cholangiography procedures like ERCP. The main objective of the study is to assess the diagnostic efficacy of USG and MRCP in detecting the level and cause of obstruction in patients with obstructive jaundice taking MRCP as a gold standard.

OBJECTIVES

1. To assess the diagnostic accuracy of Ultrasonography (USG) considering Magnetic Resonance Cholangiopancreatography (MRCP) as a gold standard in patients with obstructive biliopathy.
2. To compare the findings of Ultrasonography (USG) and Magnetic Resonance Cholangiopancreatography (MRCP) in patients with obstructive biliopathy referred to Radiology Department of Tripura Medical College & Dr BRAM Teaching Hospital.

MATERIALS AND METHODS

This cross sectional study was conducted in the department of Radio Diagnosis, over a period of 09 months from March 20–Nov 20. Sixty consecutive patients who were referred to the department of Radiodiagnosis with the clinical suspicion of obstructive jaundice and elevated serum bilirubin levels were included in the study. USG followed by MRCP were done in all the patients.

SAMPLE SIZE

The sample size was calculated to 32 considering the difference between two group 0.35 and $\infty = 0.05$ (two sided) and power = 80% following sample size table. [12] However, for statistical significance, total 60 numbers of patients was included in the study.

SAMPLING PROCEDURE

Non-probability purposive sampling. All the referred patients with obstructive biliopathy during the study period were included in the study.

INCLUSION CRITERIA

- All OPD and IPD patients irrespective of any age, sex presenting with clinical suspicion of biliary obstruction or obstructive jaundice referred to Radiology department were included in the study.

EXCLUSION CRITERIA

- Patient not giving consent.
- Patients with contra-indications to MRI.
- Patients with pre-hepatic and hepatic jaundice.

DATA COLLECTION PROCEDURE

- Ultrasonography Examination: USG machine, model SONOACE X8, manufacturer MEDISON, probe 2 to 5 MHz was used for the study. Patient was asked for overnight fasting. USG was done after taking informed and written consent from the patient. Careful scanning of the entire course & caliber of the duct system was done to trace the extent of the duct dilatation & to localize the level of obstruction.
- MRI Examination: MRI machine, MAGNETOM Skyra 3 Tesla MRI machine of Siemens was used for the study. All patients were checked for any MRI contraindications. No special preparation was needed except for 4 to 5 hours of fasting. MRI was done after taking informed and written consent from the patient. A body coil was used for the examination. Conventional MRI of the upper abdomen was done including T1 and T2 with or without fat suppression technique. I.V. contrast medium was given in all indicated cases. MRI-MRCP images were reviewed and diagnosis was done.

STATISTICAL ANALYSIS

Ultrasonography findings are compared with the MRI-MRCP findings. The data was entered and analysis was done by appropriate SPSS version 15. Results were obtained, discussed and compared with the available literature and conclusions are drawn keeping in mind the limitation of study. Frequency, percentage, sensitivity, specificity, positive predictive value, negative predictive value, diagnostic accuracy of USG was calculated being considered MRCP as a gold standard.

ETHICAL CLEARANCE

The study was conducted after getting approval from the ethical committee, Tripura medical college and DR. BRAM teaching hospital.

RESULTS

Our study was conducted to assess the diagnostic efficacy of ultrasonography against magnetic resonance cholangiopancreatography in the evaluation of patients with obstructive

jaundice. Sixty consecutive patients with clinical suspicion of obstructive jaundice were included in our study. The youngest patient was 21 years of age, with cholelithiasis and choledocholithiasis. The oldest patient was 75 years of age with cholangiocarcinoma.

Table-1: Table showing Age distribution of study subjects

Age group(years)	No. of patients	Percentage (%)
>20	00	00
21-30	04	07
31-40	13	22
41-50	14	23
51-60	17	28
61-70	10	17
>70	02	3
Total	60	100

In the study it was observed that majority i.e. 28% of the patients with obstructive jaundice were between 51-60 years of age. The youngest patient was 21 years old with cholelithiasis and choledocholithiasis and the oldest was 75 years with cholangiocarcinoma.

Figure 1: Bar diagram showing age distribution among the study subjects

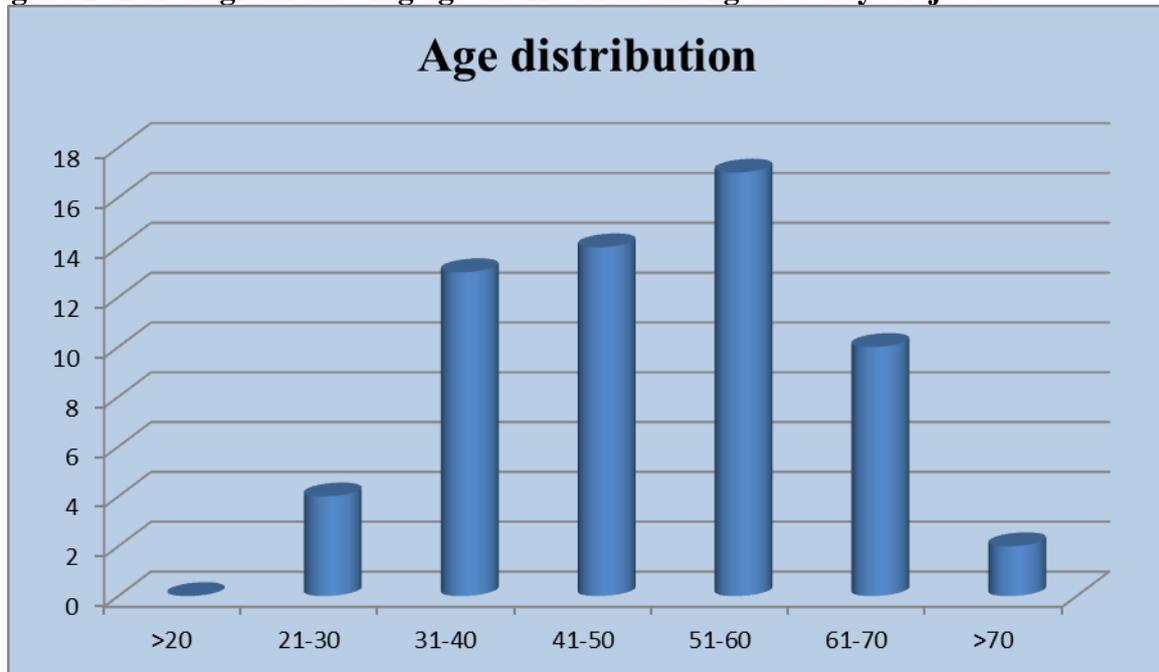


Table 2: Table showing gender distribution of the study subjects

Sex	No. of patients	Percentage (%)
Male	28	47
Female	32	53
Total	60	100

In our study it was observed that majority i.e. 53% of the patients with obstructive jaundice were females. It is evident that there is female preponderance in hepatobiliary disorders.

Figure 2: Pie diagram showing gender distribution in study subjects

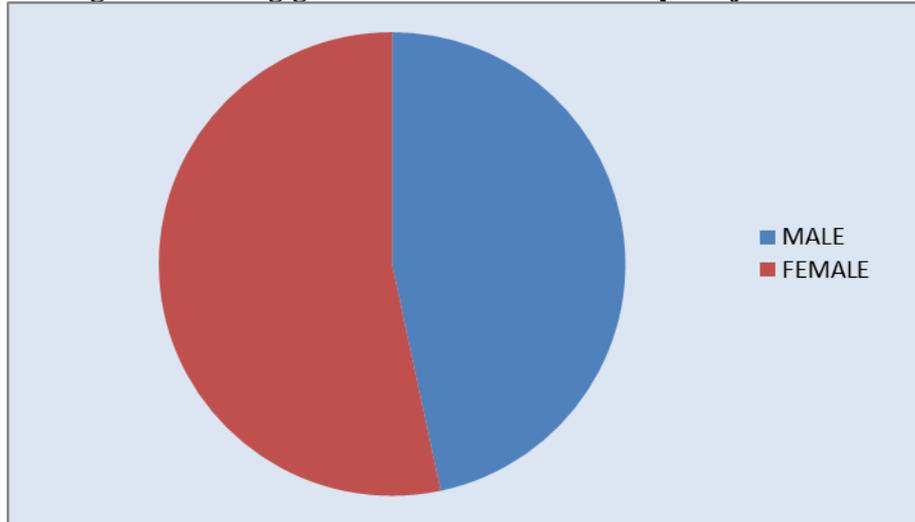


Table no- 3: Showing level of obstruction

Level of obstruction	USG (%)
Hepatic	14
Suprahepatic	30
Intrahepatic	03
	47(78.33)

USG could identify the level of obstruction in 47/60 cases with an accuracy of 78.33%.

Table 4: Table showing type of lesion causing obstructive jaundice among the study subjects

Type of lesion	No. of patients	Percentage(%)
Benign	47	78.33
Malignant	13	27
Total	60	100

In our study it was observed that out of the 60 patients with obstructive jaundice, 47(78.33%) patients had benign lesions while 13(27%) patients had malignant lesion on final diagnosis.

Figure 3: Bar diagram showing type of causes

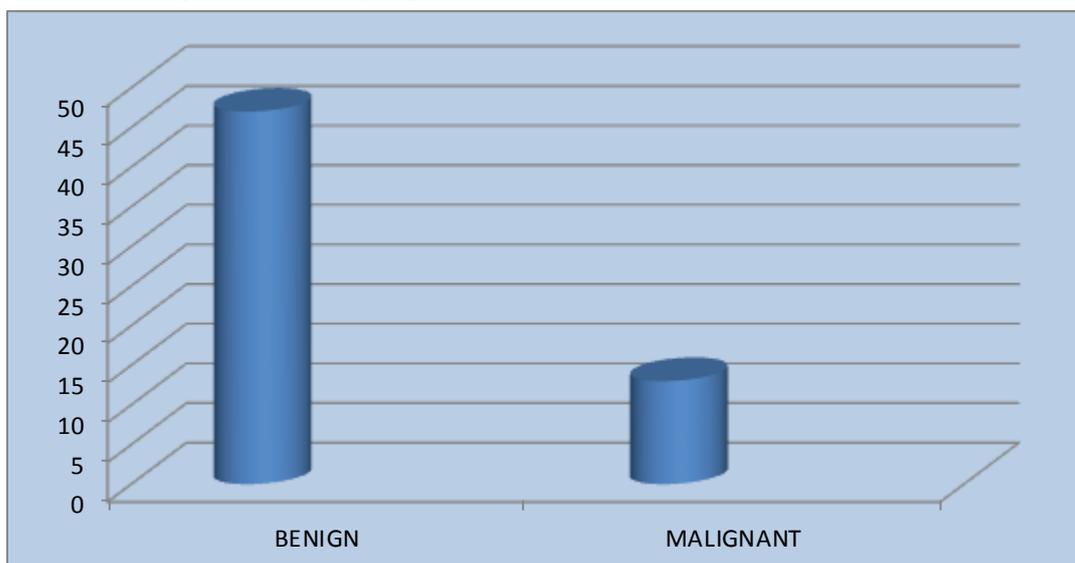


Table 05: Table showing comparison of diagnosis in patients of the suspected biliary obstruction

SL. NO	Causes of obstruction	No. of cases	USG	MRCP
	Benign causes			
		47		
1	Stone	33	28	33
2	Benign stricture	04	01	04
3	Choledochal cyst	04	04	04
4	Mirizzi syndrome	02	02	02
5	Chronic pancreatitis with pseudocyst	04	04	04
Malignant causes		13		
1	Cholangiocarcinoma	05	03	05
2	Carcinoma gall bladder	03	03	03
3	Peri ampullary carcinoma	04	01	04
4	Carcinoma head of pancreas	01	01	01
Total		60	47	60

In our study, it was observed that the most common benign cause for obstructive jaundice was CBD with calculi and GB calculi. Least common cause for obstruction was Mirizzi syndrome. In case of malignant obstruction most common malignant cause in cholangiocarcinoma and least common is carcinoma head of pancreas.

Table no-6: Baseline characteristics and diagnostic accuracy of ultrasound taking MRCP as gold standard (n=60).

Cause of obstruction	Total	Sensitivity (%)	Specificity (%)	Positive Predictive Value (%)	Negative Predictive Value (%)	Overall diagnostic accuracy (%)
Benign causes	47					
Stone	33	93.3	100	100	60	93.9
Benign stricture	04	66.6	100	100	50	75
Choledochal cyst	04	100	100	100	100	100
Mirizzi syndrome	02	100	100	100	100	100
Chronic pancreatitis with pseudocyst	04	100	100	100	100	100
Malignant obstruction	13	88	100	100	50	87.5

In our study, USG identified the benign cause of obstruction in 39 out of 60 cases. USG showed diagnostic accuracy of 93.9% in diagnosing the stone. USG also showed difficulty in picking up distal CBD calculus in 05 patients. In malignant causes, USG identified only 08 cases with diagnostic accuracy of 87.5%. 02 cases of cholangiocarcinoma and 03 cases of peri ampullary carcinoma were not diagnosed with USG. While MRCP has correctly identified the benign and malignant cause of obstruction in all cases with 100% accuracy. So overall, MRCP has a greater sensitivity, specificity and diagnostic accuracy than USG in diagnosing various causes of obstructive jaundice.

IMAGES

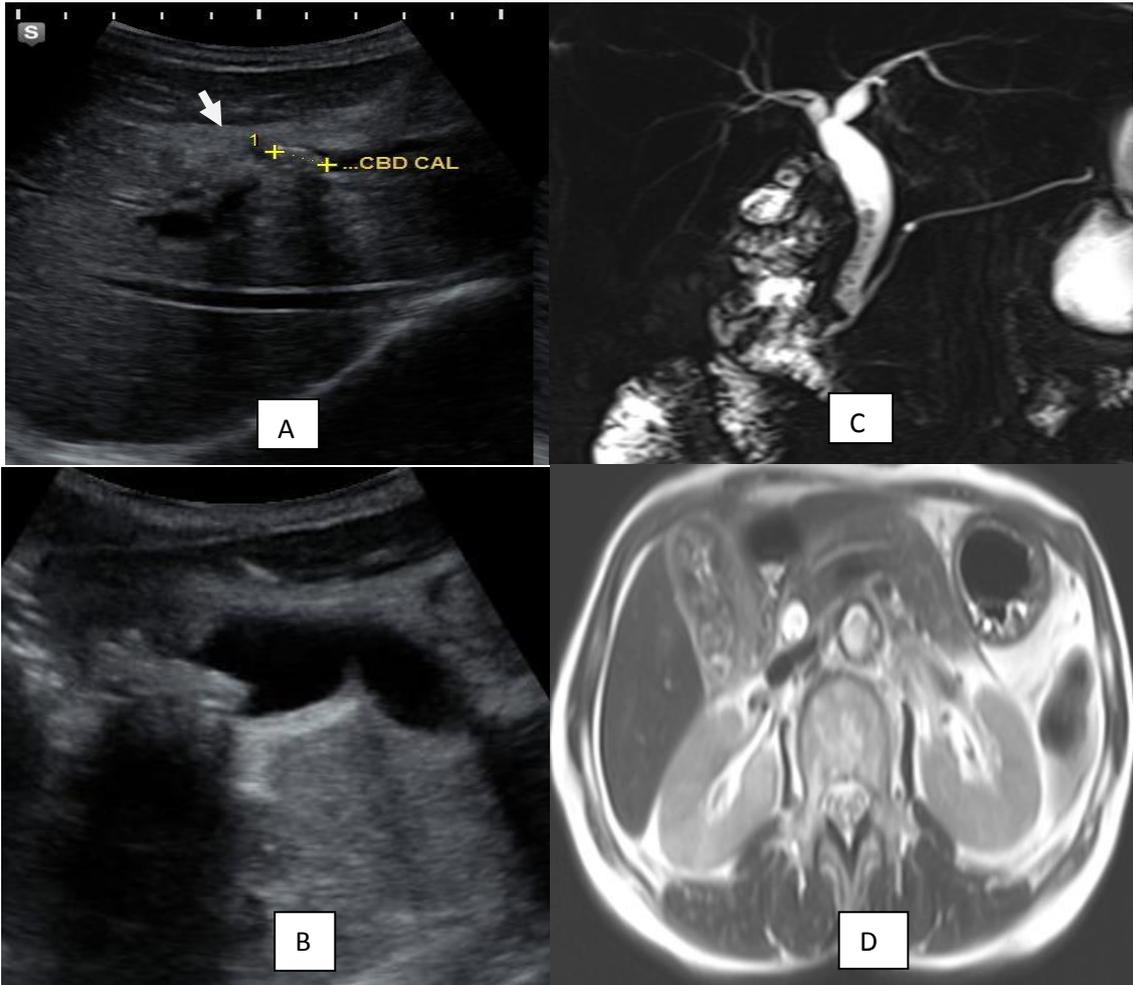
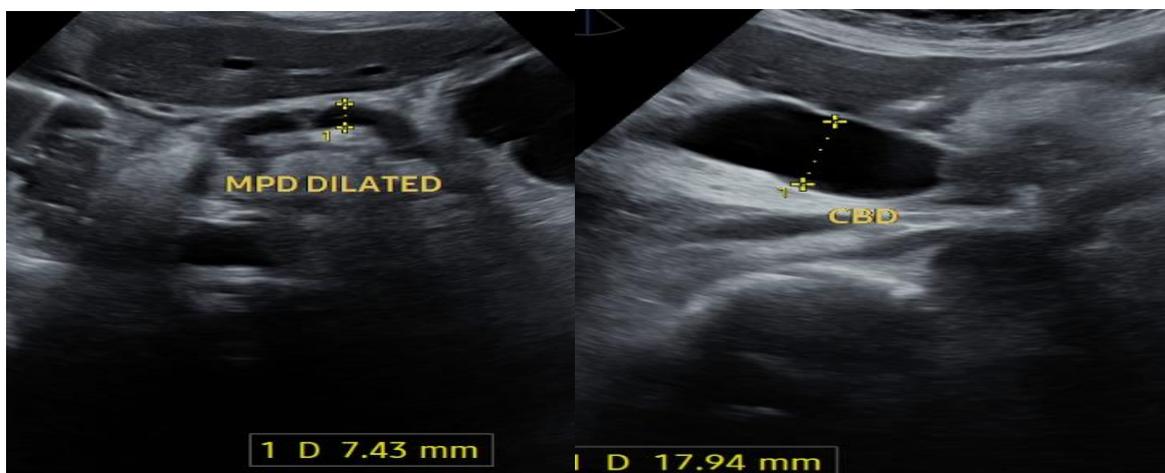


Figure 1: Cholelithiasis with choledocholithiasis-USG image – (A) A rounded calculus in mid part of CBD. (B) Multiple calculi in gall bladder lumen. MRCP image – (C) Multiple calculi in distal part of CBD with dilated CBD and IHBR on thick slab image. (D) T2 HASTE axial image shows contracted gall bladder, multiple calculi in gall bladder lumen with thickened wall.



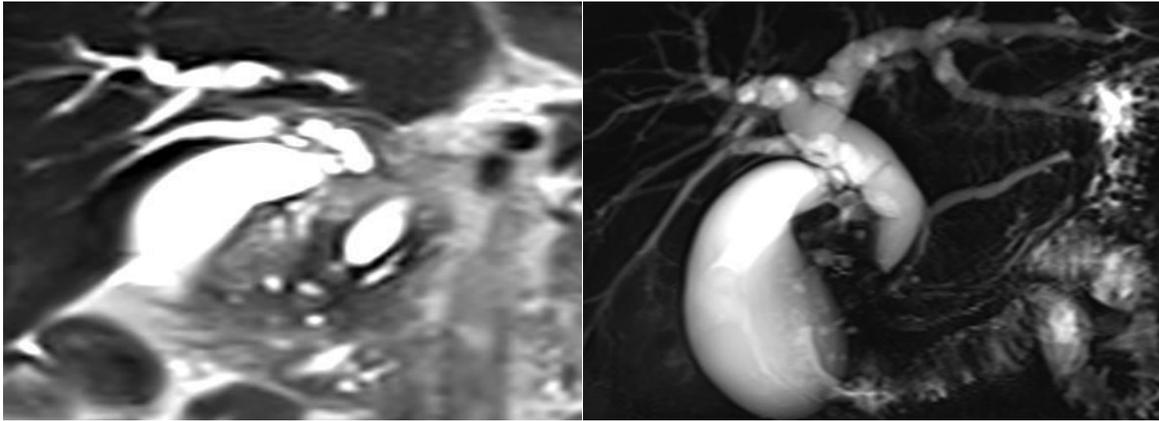


Figure 2: Periampullary carcinoma. USG image – Dilatation of MPD & CBD with non-visualization of distal part of CBD. MRCP image – A periampullary mass with mild dilatation of biliary radicals compressing the distal part of CBD on T2 HASTE coronal and T2 HASTE thick slab coronal.

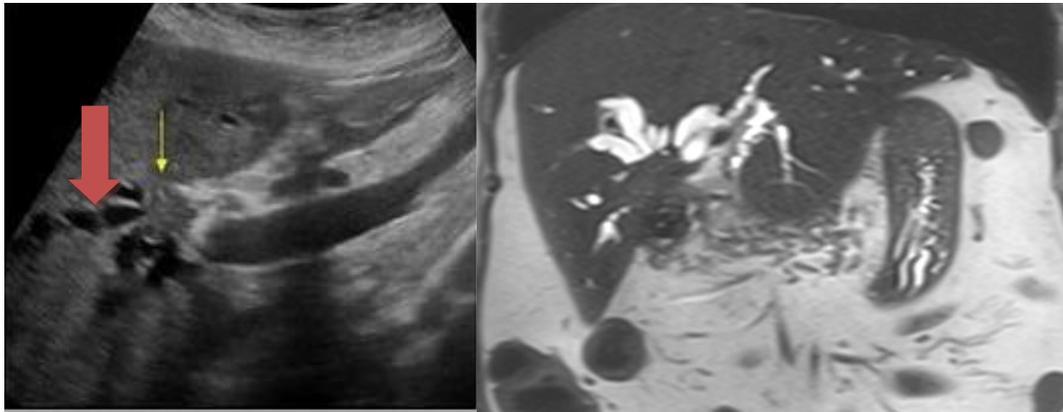


Figure 3: Cholangiocarcinoma. USG image – An ill-defined soft tissue mass lesion in common hepatic duct with dilatation of IHBR. MRCP image – Ill-defined mass lesion in hepatic confluence with upstream dilatation of biliary radicals on T2 HASTE coronal.

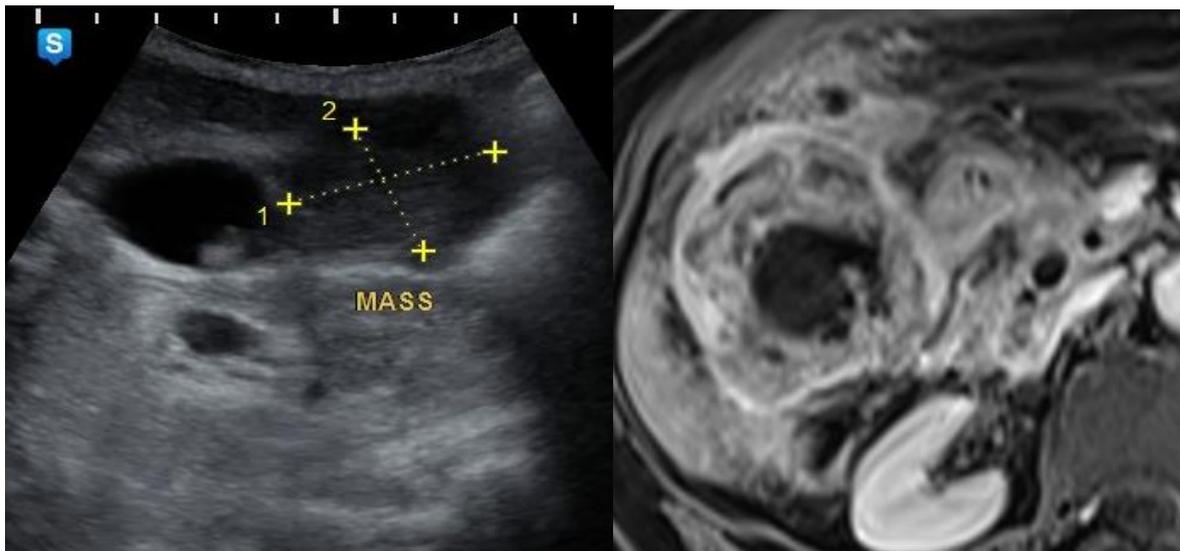


Figure 4: Infiltrating gall bladder carcinoma: USG image – An ill defined mass lesion in fundal region of gall bladder invading the liver with a calculus in lumen. MRCP image – Irregular circumferential thickening of gall bladder wall with heterogeneous contrast enhancement on post contrast T1 axial image.



Figure 5: Pancreatic head mass. USG image – An ill-defined irregular margined soft tissue mass lesion involving head of the pancreas. MRCP image – Heterogeneously enhancing solid cystic mass lesion is seen in uncinus process and head of pancreas invading the duodenum on T1 post contrast axial image.

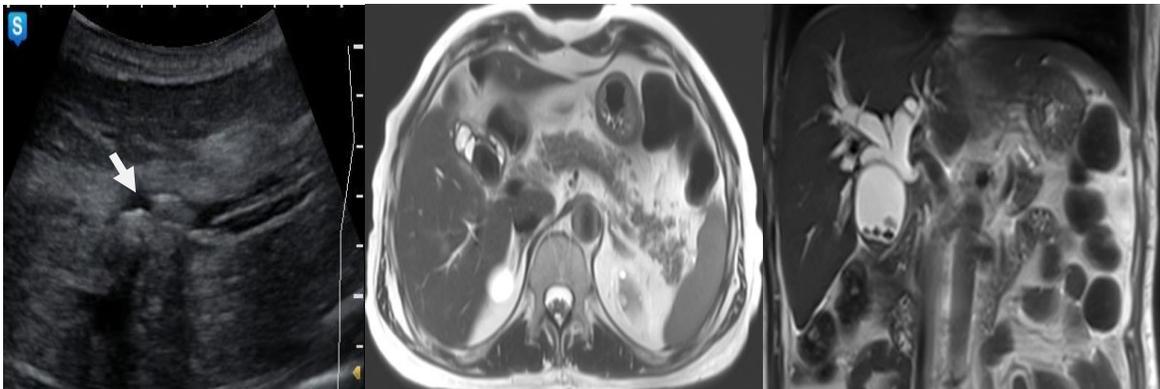


Figure 6: Mirizzi syndrome. USG image- A calculus is seen impacted in cystic duct. MRCP image- Multiple calculi in gall bladder lumen with a large impacted stone in cystic duct compressing the common hepatic duct results in dilatation of IHBR.

DISCUSSION

Diagnosing patients with obstructive jaundice in their initial stage is of utmost importance in patient care and management. Knowledge of the advantages and disadvantages of each technique is needed to determine the appropriate work up of patients with the causes of obstructive jaundice.

Ultrasonography is a non ionizing, non invasive, easy available and cheap imaging modality which made it possible for the clinicians to clarify the mist and be more specific in their diagnosis regarding the nature, extent, size and probable pathology leading to cholestasis. So, USG is the initial screening procedure which provides a guide to choose patients for MRCP examination in obstructive jaundice patients. This modality of diagnosis though widely used, but it has diagnostic limitations in case of obese patients and gaseous abdomen and sometimes in visualization of distal CBD.

MRCP has the advantage of being modality which does not use ionizing radiation or iodinated contrast. The quality of images obtained is comparable with that of direct cholangiography procedures like ERCP. In the present study, we compared the diagnostic efficacy of two noninvasive and nonradiation modalities, USG and MRI in detecting the level and cause of obstruction.

Maximum numbers of the study population (28%) were adults in the age group of 51–60 years. This correlates with the study Verma et al.,^[8] where most commonly affected age

group was 50-60 years (mean age affected 50.4 years). But in a similar study by Al-Obaidi et al.,^[9] most of the patients were in 60–69 years age group.

Our study showed female preponderance with 53% female population. This correlates with the study Singh et al.,^[2] where majority of patients were females 27 (54%) and 23 (46%) were males with male to female ratio being 1:1.7. But in a similar study by Goud set al.,^[10] majority were males (68%) population.

In our study, USG was correctly diagnosed in 47 cases out of 60 patients (constituting 78.3 % of cases). Our USG shows higher results than what is reported in studies done by Sherlock et al.,^[11] & Honickman et al.,^[12] the site of obstruction could be determined (by USG) in only 27% of the total sample. USG was unable to demonstrate the level of obstruction in 13 of cases because of excessive bowel gases, obesity & previous operations. MRI-MRCP was correct in defining the level of obstruction in all cases.

In our study the most common cause for obstructive jaundice is benign lesions i.e. 47(78.3%) cases out of 60 patients compared to malignant lesions which are accounting 13 (21.66%) cases. Our study is similar to Singh A et al.^[2] However, in a study done by Siddique et al. they have found that majority of patients had malignant obstructive jaundice, i.e., 56.66% (34/60) while the benign lesions were seen in 43.33% (26/60).^[13]

USG shows 100% accuracy in diagnosing gall bladder calculi. But USG showed difficulty in picking up distal CBD calculus in 05 patients, which was diagnosed clearly with MRCP with 100% accuracy. This shows that MRCP is superior to USG in detecting CBD calculi. CBD and GB calculi are shown in Figure 1. Our study is similar with Singh *et al.*,^[2] where they found that sensitivity and diagnostic accuracy in diagnosing CBD calculi by USG were 93.3% and 96%.

In our study, USG identified only one case of benign stricture with an accuracy of 75% while MRCP identified clearly showed the length of the stricture segment very well with 100% accuracy. In contrast to this study, Pandit SP et al.,^[14] in their study found accuracy of 31%. In another study Ferrari FS et al.,^[15] reported a diagnostic accuracy of 78.62% in sonographic diagnosis of benign biliary stricture. The high specificity was attributable to the capability of USG to detect true negatives in benign stenosis, thus showing the cause of the obstruction by calculi or malignant stenosis.

Four cases of choledochal cyst were correctly diagnosed by both USG and MRCP with 100% accuracy. Ultrasound is the initial method of evaluation as found in a study done by OH Kim et al.,^[16] MRCP result was similar to that observed by Celso Matos (1998)^[17]

In our study of 13 patients are diagnosed as a malignant. Out of 13 cases 05(21.6%) were cholangiocarcinoma, 03 cases were gall bladder carcinoma, 04 cases were periampullary, and one case were pancreatic cancer. Our study reported, cholangiocarcinoma is the most common one. This study is similar to studies done by Karki et al.,^[18] and Singh et al.,^[2] where they found that cholangiocarcinoma being the most common malignant cause of obstructive jaundice.

In 05 patients with cholangiocarcinoma as shown in Figure 3, USG showed growth in 03 cases with diagnostic accuracy of 80%.

In all 04 patients with periampullary growth (Figure 2), USG identified the growth in the periampullary region in 01 patient. USG could not identify the growth in 03 patients because of the poor window due to bowel gas and obese patients.

In our study, GB Carcinoma diagnosed all 4 cases by USG shown in figure 4.

Our study shows 4 cases of chronic pancreatitis with pseudocysts correctly diagnosed by USG with an accuracy of 100%.

02 cases of Mirizzi syndrome shown in figure 5 were correctly diagnosed by USG with an accuracy of 100%.

One case is diagnosed correctly as a malignant mass lesion in the pancreas as shown in Figure 6 by USG.

So, overall our study shows, diagnostic accuracy, sensitivity, and specificity of USG in benign and malignant lesions were 97.4%, 97.2%, and 67% and malignant lesions were 87.5%, 86% and 100%. In the study conducted by Singh *et al.*^[2], overall diagnostic accuracy, sensitivity, and specificity of USG in benign causes are 88%, 80.7%, and 95.8%, and malignant causes are 88%, 79%, and 96%. Diagnostic accuracy, sensitivity, and specificity of MRCP in benign causes are 98%, 100%, and 95%.

LIMITATIONS OF THE STUDY

Few limitations exist in our study like excessive bowel gas shadows were present in some of the patients, obscuring the details of the pancreas, periampullary and peri pancreatic region which might have resulted in missing some of the important causes of obstructive jaundice on ultrasound. Despite of these limitations, our study offered an approach for diagnosis of obstructive jaundice by the help of ultrasound. Our present study have provided the local statistics related to diagnostic accuracy of ultrasound in diagnosis of obstructive jaundice taking findings of MRCP as a gold standard.

CONCLUSION

MRCP has a high sensitivity, specificity and diagnostic accuracy in diagnosis of obstructive jaundice compared to USG. But ultrasound still remains the primary investigative modality of choice to identify the presence or absence of intrahepatic biliary duct dilatation thereby shortlisting the patients for MRCP examination. MRCP also serves as an accurate, non invasive and non ionizing imaging method for evaluation of pancreatobiliary anatomy and pathology and investigation of choice for characterization of the causative lesions in most of the cases obstructive jaundice which allows safe surgical management decisions.

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