ORIGINAL RESEARCH

The Accuracy of transabdominal ultrasound in obstructive jaundice as compared to magnetic resonance cholangio-pancreatography

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Abstract
Obstructive jaundice has been established as one of the leading causes of increased morbidity. It has been mainly diagnosed by imaging modalities. Therefore the main objective of this study is to know the cause, level and grade of obstruction in case of clinically suspected biliary obstruction by USG and MRI and to categorize causes as congenital or acquired.
After obtaining informed consent and institutional ethical committee clearance, a total number of 50 study subjects with clinical and laboratory features suggestive of obstructive jaundice of all age groups and either sex referred to the Department of Radio-diagnosis. Ultrasonography followed by MRI-MRCP were done in all the patients and analyzed separately in a blinded fashion without knowledge of the results of other examinations. MRCP was taken as gold standard in making final diagnosis.
USG in detecting congenital causes had Sensitivity & PPV of only 50% and diagnostic accuracy of 92%. USG had Sensitivity & PPV of 91.7% and Diagnostic accuracy of 96% in detecting CBD calculus, which was diagnosed clearly with MRCP with 100% accuracy. Diagnostic accuracy of MRCP in detecting malignancy was 100% and USG was 92%.
It is recommended that ultrasound can be used as a screening imaging technique to identify the presence or absence of intrahepatic biliary duct dilatation thereby shortlisting the patients for MRCP examination. MRCP has potential role in delineating the malignant cause of obstructive jaundice, approaching almost 100% in accuracy.
Keywords: Obstructive jaundice; Ultrasound; MRI-MRCP

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Introduction

Obstructive Jaundice has been documented as one of the leading causes of increased morbidity. Any blockage in the hepatobiliary pathway 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. It is a common clinical problem and it is important to evaluate it quickly for prompt treatment and prevent complications. According to a study, 17.1% of cases of jaundice are due to obstruction commonly with involvement of pancreatic and biliary system.Laboratory investigations like increased serum conjugated bilirubin (>3 mg/dL) and alkaline phosphatase (ALP) help in the diagnosis of obstructive jaundice[1].

Obstructive jaundicehas been mainly diagnosed by imaging modalities. The main goals ofimaging procedure are to confirm the presence of obstruction, its location, extent, probable cause and it should also attempt to obtain a map of biliary tree that will help the surgeon to determine the best approach to each individual case.

Information about the level and cause of the obstruction can be known by various anatomic imaging modalities**.** ERCP is considered as Gold standard in the evaluation of biliary tree, but it is an invasive technique and is associated with complications like pancreatitis.

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Ultrasonography (USG) and contrast-enhanced computed tomography (CT) are initial modalities of investigations. Ultrasound has easy accessibility, speed, ease of performance and low cost[2]. The diagnostic accuracy of U/S in differentiating obstructive from non-obstructive jaundice is estimated to be high in the order of about 90%[3,4]. MRCP has a very high sensitivity and specificity of 98% each in diagnosis of obstructive jaundice as compared to ultrasound which has sensitivity and specificity of 88% each respectively[5].

Though USG is very useful to visualize the common hepatic duct and proximal common bile duct, its major limitation is the difficulty in the visualization of distal common bile duct and pancreas due to obscuration by overlying bowel gas in 30%–50% of cases and obesity can degrade the image quality. CT is more accurate than USG but it uses ionizing radiation[1].

Recently magnetic resonance cholangiopancreatography (MRCP) has revolutionized the imaging of biliary and pancreatic ducts and has emerged as an accurate, noninvasive means of visualization of the biliary tree and pancreatic duct without injection of contrast materia1. Since its introduction by Wallner*et al* in 1991, MR Cholangiopancreatography has undergone a wide range of changes.[6] The quality of images obtained is comparable with that of direct cholangiography procedures like ERCP.[7] The diagnostic accuracy of MRCP suggests that, it has the potential to replace the more invasive procedures like diagnostic ERCP, which should be used only in cases where intervention is being contemplated.

The principle of MRCP is based on use of heavily T2 weighted fast spin echo sequences. As a result, stationary or slow moving fluid 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.[8,9]

With the development of higher magnetic field strength and newer pulse sequences like HASTE (Half Fourier Acquisition Single Shot Turbo Spin Echo) and RARE (Rapid Acquisition and Relaxation Enhancement), Magnetic Resonance Cholangio-pancreatography with its inherent high contrast resolution, multiplanar capability and virtually artifact free display of anatomy and pathology, is proving to be imaging of choice in these patients.[10]

Methodology

A total number of 50 patients with clinical and laboratory features suggestive of obstructive jaundice of all age groups and either sex referred to the Department of Radiodiagnosis were included in this study.

Inclusion criteria

1. Patients of all ages and all sex.
2. Patientswith suspected biliary obstruction with clinical and laboratory features suggestiveof obstructive jaundice.

Exclusion Criteria

1. Patients having cardiac pacemakers and electromagnetic implants.
2. Patients having severe claustrophobia.
3. Obese patients.
4. Patients with excessive bowel gas shadow.
5. Pregnant females.
6. Psychiatric patients.

All the patients had undergone Ultrasonography followed by MRI-MRCP.

The study protocol was approved by the ethical committee. All the patients gave informed consent to participate in the study. Patients were excluded if considered unsuitable for USG or MRI.

For study purpose we tend to refrain patients from ERCP or biliary drainage prior to MR procedure to avoid artifacts inthis examination.

Patient preparation for USG

- All the patients were instructed to come with empty stomach on the day of procedure.

Patient preparation for MRI-MRCP

- All the patients were instructed to fast for 6 hours prior to examination.
- All the metallic belongings removed prior to MR examination.

Methods

Ultrasound was performed by usingGE LOGIQ P9 AND LOGIQ P5 machines. Both curvilinear and linear probes were used in the study. Images were recorded for later review.

MRI-MRCP was performed by using Philips Achieva 1.5 Tesla MRI machine.All images were obtained with breath holding and parameters were individualized to optimize each for a suspended breathhold of about 15s. All conventional sequences were acquired in axial plane.

Protocol for MRCP: Thick slab T2W images, Thin T2W images (can be reconstructed), T2 axial and coronal, T2 fat sat, T1, DWI and 3D MRCP.

Results

Table 1:Identification of caliculi by USG and MRI/MRCP

Caliculi	Detected By MRCP	Detected BYUSG	Percent
CHD CAL	1	0	0.0
CBD CAL	13	5	38.5

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GB CAL	16	16	100.0
Total	30	21	70.0

GB calculi was detected by both USG and MRI. While none of the CHD calculi were detected by USG. Only 5 (38.5%) out of 13 cases of CBD calculi was identified by by USG.

Table 2: Showing diagnostic ability of USG in detecting CBD calculus

CBD CAL	MRI Present	MRI Absent	Total
USG Present	11	1	12
USG Absent	1	37	38
Total	13	37	50
SN:91.7%SP:97.4% PPV:91.7% NPV:97.4% DA:96%			

USG in detecting CBD calculus had Sensitivity and PPV of 91.7%.

Table 3: Showing diagnostic ability of USG in detecting congenital causes.

Causes	MRI Acquired	MRI Congenital	Total
USG Acquired	44	2	46
USG Congenital	2	2	4
Total	46	4	50
SN:50% SP:96.7% PPV:50% NPV:95.65% DA:92%			

USG in detecting congenital causes had Sensitivity and PPV of only 50%.

Table 4: Showing diagnostic ability of USG in detecting malignant causes.

Benign/malignant	MRI benign	MRI malignant	Total
USG Benign	37	3	40
USG Malignant	1	9	10
Total	38	12	50
SN: 75% SP:97.4% PPV:90% NPV:92.5% DA:92%11			

USG in detecting malignant causes had Sensitivity of 75% and PPV of 90%.

Table 5:Diagnostic performance of USG for different causes of biliary obstruction

Screening by USG	FOR Malignancy	For CBD CAL	For Congenital Causes
SN	75%	91.67%	50%
SP	97.37%	97.37%	95.65%
PPV	90%	91.67%	50%
NPV	92.50%	97.37%	95.65%
DA	92%	96%	92%
SN: sensitivity, SP: specificity, PPV: positive predictive value, NPV: negative predictive value, DA: diagnostic accuracy			

Discussion

In the present study, USG and MRCP were able to detect gall bladder calculi in all cases with 100% accuracy. USG showed difficulty in picking up CBD calculus in 8 patients. USG had Sensitivity and PPV of 91.7% and Diagnostic accuracy of 96% in detecting CBD calculus, which was diagnosed clearly with MRCP with 100% accuracy. This shows that MRCP is superior to USG in detecting CBD calculi. The present study is in concordance with Guidbaud*et al.*, in their study, they found an accuracy of 100% in detecting CBD calculi on MRCP in cases with equivocal sonographic and CT results[6]. Our study is also in concordance with Soto *et al.*, in their study, reported a sensitivity of 94% and specificity of 100% for detecting biliary calculi in MRCP[11]. The study of Stephan *et al.*, found that the sensitivity of MRCP/USG in diagnosing CBD calculus was 87%[12]. Singh *et al.*,in their study found that sensitivity and diagnostic accuracy in diagnosing CBD calculi by USG were 93.3% and 96% [13]. In our study, USG had Sensitivity of 91.7% and PPV(91.7%) in diagnosing CBD calculi.

In our study, benign pancreatic causes were found in 4 (10.8%) subjectswhich includes 2 cases of chronic pancreatitis with MPD calculus, 1 case of acute necrotizing pancreatitis with cholelithiasis and another case of acute pancreatitis with multiple pseudocysts.

In this study, 6 (12%) study subjects had congenital etiology for obstructive jaundice. USG in detecting congenital causes had Sensitivity andPPV of only 50%and diagnostic accuracy of 92%. Choledochal

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cyst was present in 4 subjects each and biliary atresia was seen in 2 subjects.Fourcases of choledochal cyst was diagnosed with MRCP and USG. Our study is in concordance with Bhatt *et al*., in their study, they found 100% accuracy for MRCP in diagnosing anatomical variants[14]. Rest 44 (88%) had acquired etiology. According to Donald R. Kirks *et al*, biliary atresia is the most common cause of conjugated hyperbilirubinemia in neonate[15].

In the present study, out of 13 cases with malignant cause of obstructive jaundice, cholangiocarcinoma and GB malignancy were most common with 4 (30.8%) cases each, followed by periampullary carcinoma and pancreatic carcinoma with 2 (15.4%) cases each and malignant stricture with 1 (7.7%) case. USG in detecting malignant causes had Sensitivity of 75% and PPV of 90%.USG could not identify the growth in 3 subjectspossbily because of the poor window due to bowel gas. Diagnostic accuracy of MRCP in detecting malignancy was 100% and USG was 92%. Our study is in concordance with Anderssone*t al.*,in their study, they found MRCPwas more accurate than USG[16].

Conclusion

USG in detecting malignant causes had Sensitivity of 75% and PPV of 90%.

But it is still MRCP that has potential role in delineating the malignant cause of obstructive jaundice, approaching almost 100% in accuracy.

Ultrasound has a high sensitivity, moderate specificity and a high diagnostic accuracy in diagnosis of obstructive jaundice. It is recommended that ultrasound can be used as a screening imaging technique to identify the presence or absence of intrahepatic biliary duct dilatation thereby shortlisting the patients for MRCP examination. If the patients are not feasible to undergo MRCP examination, then other investigations such as contrast enhanced computed tomography or ERCPcan be performed in such patients.

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