

ROLE OF ULTRASONOGRAPHY IN DETECTING COMMON BILE DUCT CALCULUS IN RESPECT TO MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY

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ABSTRACT

BACKGROUND

Obstructive jaundice due to bile duct calculus is one of the frequent clinical problems which needs proper diagnosis before initiation of treatment. USG and MRCP play a very important role to diagnose such calculus.

MATERIALS AND METHODS

Initial USG evaluation of patients with Obstructive Jaundice was done. Then those patients having biliary obstruction due to calculus or due to causes not detected by USG were subjected to MRCP.

RESULTS

Detection rate of calculus by USG In comparison to MRCP- 1) Proximal bile duct- 92.85%. 2) Distal bile duct - 77.27%.

CONCLUSION

USG should be done as initial examination which provides a guide to choose patients for MRCP examination in detecting bile duct calculus.

KEYWORDS

Obstructive jaundice, Common Bile Duct, Dilated Bile Duct, Calculus, USG, MRCP.

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BACKGROUND

Common Bile duct pathologies like Duct Calculus, Choledochal Cyst, Stricture, Mass lesions are mostly encountered causes of obstructive jaundice which may occur in any age group. It is associated with significant morbidity and mortality. Though clinical data such as history, physical examination and laboratory tests can differentiate between intrahepatic and extra hepatic biliary pathologies in 90% of patients, the cause and site of obstruction is diagnosed by imaging modalities.¹ The main goals of any imaging procedure in obstructive jaundice are to confirm the presence of obstruction, its location, extent, probable cause, and it should also attempt to obtain map of the biliary tree that will help the surgeon to determine the best approach to individual cases. Despite the technical advances it can pose problems in diagnosis and management. Ultrasound has been always considered the first choice technique in the study of biliary obstructive disease, due to its accessibility, speed, ease of performance, no radiation hazards and low cost. Ultrasound is used as an initial modality to confirm or

exclude duct obstruction, which it does with at least 90% accuracy.^{2,3} MRCP is highly useful and has different advantages like its high-resolution images of the biliary tree, non-invasive, no requirement of contrast medium injection etc. Pathology located in distal CBD (periampullary region) is often missed by USG due to overlying bowel gas shadow or in obese patient which can be detected more accurately by MRCP.^{4,5,6} Endoscopic retrograde cholangiopancreatography (ERCP) is another technique that combines the use of endoscopy and fluoroscopy to diagnose and treat certain problems of the biliary or pancreatic ductal systems. But it is invasive procedure. In our study we tried to compare the accuracy of USG with that of MRCP in detecting calculus as a cause of biliary obstruction.

Aims and Objectives

1. To evaluate patients with clinical suspicion of biliary tract obstruction with Ultrasonography and magnetic resonance cholangiopancreatography.
2. To compare accuracy of ultrasonography in diagnosing suspected cases of bile duct calculus in comparison to magnetic resonance cholangiopancreatography.

MATERIALS AND METHODS

Inclusion Criteria

1. Patients referred to the department of radio diagnosis with clinical suspicion of obstructive jaundice.

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2. Patients detected with dilated CBD on ultrasonography.
3. Patients above 10 years of age.

Exclusion Criteria

1. Patients diagnosed with biliary obstruction due to other causes like pancreatic pathology, mass lesion, worm, stricture etc.
2. Patients who underwent recent interventional procedures on the biliary tract.
3. Patients with cardiac pacemakers or other electromagnetic devices.
4. Severe claustrophobia.
5. Patients who were unable to hold their breath for the interval required.

Procedure

We selected 50 patients with suspected biliary obstruction referred to the department of Radio-diagnosis, North Bengal Medical College after considering inclusion and exclusion criteria, Initial USG evaluation of those patients was done. Trans-abdominal ultrasonography was performed with 2-5 MHZ curvilinear transducer in HD-7 model M/S PHILIPS after proper bowel preparation. Those patients having biliary obstruction due to calculus or due to causes not detected by USG were subjected to MRCP. MRCP was done by 1.5 Tesla GE SignaHDc MRI machine using standard MRCP protocol. For MRCP proper bowel preparation was done. Patients were given iron syrup in fasting state (at least 6 hours) for suppressing signal from stomach fluid.

Protocol for MRCP

During the MRCP examinations, respiratory motion induced blurring is the limiting factor for demonstration of the biliary and pancreatic ductal system and different approaches have been considered to overcome this problem. Single-shot fast spin-echo (SSFSE) is the current sequence of choice for MRCP, because it essentially eliminates the problem of motion artifact. For MRCP no contrast is required because heavily weighted T2 sequences are used. MRCP begins with 3 plane localizer. The use of 3D T2 sequences is optimized with fast recovery and variable flip angle approaches. This allows for near isotropic imaging of biliary tree.

We use Following Sequences-

- Axial T2W RTR, Axial T1, 3D MRCP, Coronal T2 and Axial T2 Thin slices (whenever indicated).
- Results of USG and MRCP were noted and analysed.

RESULTS

Age Distribution of Study Population

Age in Years	No. of Patients
10-20	5
20-30	9
30-40	16
40-50	13
≥50	7

Table 1. Distribution of Cases According to Age Group

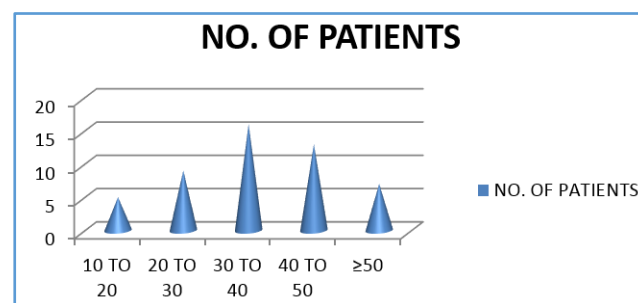


Figure 1. Distribution of Patients According to Age Group

Sex Distribution of Study Population

Sex	No. of Patients
Male	23
Female	27

Table 2. Distribution of Cases According to Sex

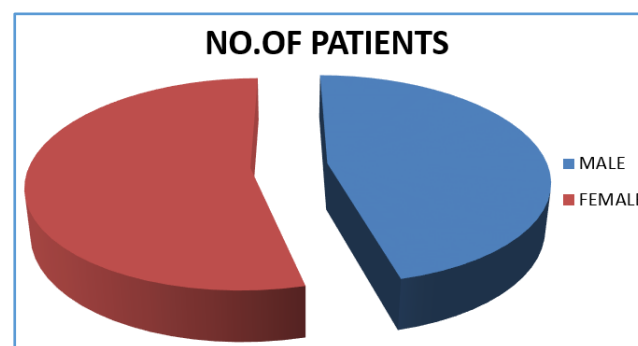


Figure 2. Pie Chart Showing Distribution of Patients According to Sex

Detection of Ductal Calculus by both Modalities According to Different Levels

Modality	Proximal Bile Duct	Distal Bile Duct
USG	26	17
MRI	28	22

Table 3. Showing Number of Calculi at Different Levels by Both Modalities

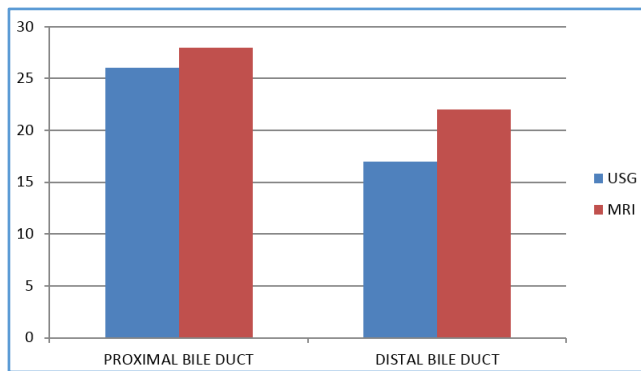


Figure 3. Bar Diagram showing Distribution of Calculi in both Modalities

Detection rate of calculus by USG in comparison to MRCP-

- Proximal bile duct- 92.85%.
- Distal bile duct - 77.27%.
- So overall detection rate- 86%.



Figure 4. 2D USG Showing Two Calculi in Mid and Distal CBD



Figure 5. USG Shows Dilated CBD with Multiple Calculi

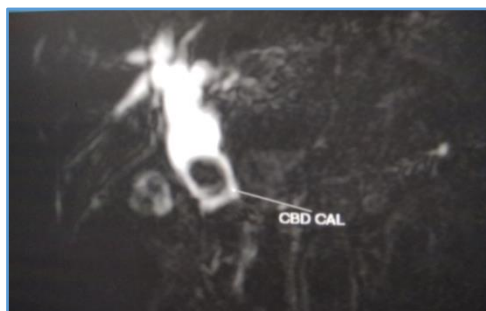


Figure 6. 3D MRCP Image Shows Calculus in Terminal Part of CBD



Figure 7. MRCP (3D) Shows Multiple Calculi in Distal CBD with Mild Dilatation of CBD



Figure 8. Reconstructed MRCP Image of Solitary Calculus in Distal CBD

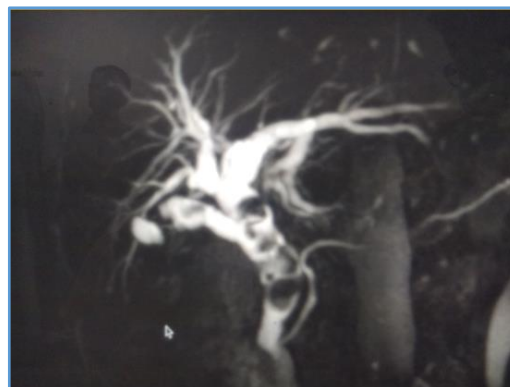


Figure 9. MRCP Image Showing Multiple Calculi in RHD CHD and CBD. Calculus of RHD was Missed in USG



Figure 10. USG Showing Minimally Dilated CBD Failed to Detect Calculi in Distal CBD

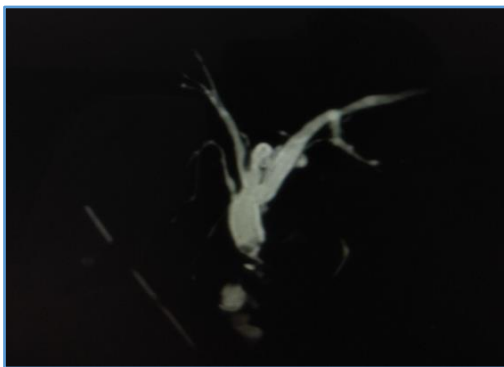


Figure 11. MRCP Image (Same Patient of Fig. 10) Shows Minimally Dilated CBD with Few Small Calculi in Distal CBD Which Were Missed in USG



Figure 12. MRCP Shows Tiny Distal CBD Calculus not Detected in USG

DISCUSSION

54% of our patients were females rest were males. Maximum number of patients were in the age group of 30-40 years. In our study, 50 patients had calculus in bile duct on MRCP but on USG we detected 43 cases. 2 cases with proximal bile duct calculus were missed while 5 cases were missed in distal part.

These Differences could be Explained as Follows-

1. USG may not visualize the most distal part of CBD (due to overlying bowel gas or mass lesion) while MRCP define the whole duct.
2. USG is operator dependent.
3. Calculus in non-dilated bile duct may be missed by USG.

A Study conducted by Ferrari FS et al in Italy, in 2003 to compare the reliability of diagnostic USG, MRCP and other imaging techniques in intrinsic biliary obstructive disease showed that, USG has a diagnostic accuracy of 80.15% in diagnosing stones. They found that Ultrasonography is less sensitive but highly specific compared to MRCP in diagnosing lithiasis and stenosis.⁷ This correlates with our findings.

In a study conducted by Bhatt C et al in Ahmedabad, India in 2005 to evaluate the diagnostic accuracy between USG and MRCP among 50 patients suspected of biliary and pancreatic pathology, which were examined first by USG and then followed by MRCP, the findings were then correlated

with ERCP and biopsy report. MRCP was 98% accurate in diagnosis, while USG was not so accurate in finding lower CBD pathology. They concluded that USG is primary investigative modality for suspected biliary and pancreatic pathology because it is easily available modality and it is cheap, but MRCP has high diagnostic value. We also concluded that USG is not so good for distal CBD calculus however it should be first line investigation in suspected bile duct calculus.⁸

Khandelwal N et al performed a study in Department of Radiodiagnosis and Imaging, Postgraduate Institute of Medical Education and Research, Chandigarh regarding Ultrasound in choledocholithiasis. Twenty-five patients of obstructive jaundice due to choledocholithiasis, were prospectively evaluated by ultrasonography and cholangiography. They found that Ultrasound could demonstrate choledocholithiasis in 10 patients (40%). Choledocholithiasis in non-dilated ducts could be demonstrated only in one patient. All cases were diagnosed by cholangiography. They concluded that Ultrasound, though an accepted modality of choice for diagnosing cholelithiasis, has a limited role in the diagnosis of choledocholithiasis. However, our result differs from their observation, this could be due to small sample size of their study and probably they had more number of patients with nondilated ducts.

Pavone et al in 2000 reported that the accuracy of MRCP in diagnosing the presence of obstruction ranges between 91-100%, whereas the level of obstruction could be correctly evaluated in 85-100% of cases that approximates our results.⁹

As per text book of Radiology and Imaging 7th edition (vol 1) by David Sutton diagnostic accuracy of bile duct calculus detection is 79% which correlates with our results.¹⁰ A study conducted by Upadhyaya V et al at BHU, Varanasi, India in 2003 to compare the diagnostic accuracy of Ultrasonography, Computed tomography, ERCP/PTC and MRCP in assessing the level and cause of obstruction in patients with obstructive jaundice. They found that USG can diagnose level of obstruction in 83.50% of patients and its cause in 77%.¹¹ It is almost similar to our study.

A Study was conducted by Verma SR et al in a tertiary care teaching hospital, Meerut in 2011 to assess the aetiological spectrum of obstructive jaundice as well as common clinical findings and relevance of laboratory and radiological imaging investigations. The abdominal Ultrasound was able to diagnose dilatation of biliary system (intra or extrahepatic) in 96.4% of the cases, the level of obstruction was correctly identified in 92.6% of cases, while cause of obstruction was delineated in 85.3% cases.¹² This is consistent with our study.

A study done by Tse F et al in England in 2003 to review competing technologies in evaluation of suspected extra hepatic obstruction. USG had been shown to be highly accurate (78% to 98%) for detecting extrahepatic obstruction. MRCP had an excellent overall sensitivity of 95% and specificity of 97% for demonstrating the level and

presence of biliary obstruction.¹³ This corroborates with our findings.

Our USG results were comparable to the findings of Abbas (1999)¹⁴ and that of Dixit et al (1993)¹⁵ and higher than what is reported by Salazar et al (1993).¹⁶ While Rigauts et al (1992) found that USG successfully detect ductal calculus with 96% sensitivity.¹⁷ Our MRCP results are similar to what is mentioned by Al-Janabi (2002)¹⁸ and Mendler et al (1998).¹⁹

CONCLUSION

After analysis of our findings, we come to conclusion that-

1. Although USG provides good information about the presence and level of bile duct calculus, few cases may be missed particularly in distal part.
2. MRCP is a sensitive non-invasive technique in the detection of the presence and level of bile duct calculus.
3. USG should be done as initial examination which provides a guide to choose patients for MRCP examination.

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