



## EXPERIENCE OF EVALUATION OF PATIENTS OF OBSTRUCTIVE JAUNDICE BY SONOGRAPHY AND MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY AT A TERTIARY CARE CENTRE IN EASTERN INDIA

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**ABSTRACT** **INTRODUCTION:** Jaundice means yellow due to the yellowish discoloration of skin, sclera, and mucous membrane seen in jaundice caused by bilirubin pigment. It is divided in to two forms obstructive(surgical) and non- obstructive (non-surgical). **AIM AND OBJECTIVE:** To evaluate patients of obstructive jaundice by sonography and magnetic resonance cholangiopancreatography and compare the reporting and findings by both the modalities. **MATERIALS AND METHODS:** Cross sectional observational study done from November 2018 to October 2020 and consists of 32 patients who had clinical jaundice and consented to being subjected to both ultrasound and MRCP. **OBSERVATIONS:** Both USG and MRCP were able to detect extrahepatic CBD dilatation equally in 25 patients. In 5(15.6%) patients USG and MRI both demonstrated intrahepatic mass causing obstruction at the level of confluence of right and left hepatic duct or CHD. Ultrasonography was able to detect the intrinsic mass of the extrahepatic common bile duct in 2(6.2%) patients out of 32 patients in our study population. MRCP could detect the same in 6(18.7%) patients. In our study narrowing of CBD with stricture formation and upstream dilatation of biliary tree was identified in 10(31.2%) patients on MRCP. Ultrasound could diagnose the same in one patient. Both USG and MRCP were able to detect pancreatic head mass as well as pseudocyst. **CONCLUSION:** The accuracy of MRCP was found to be comparable to that of ERCP for diagnosis of etiology for obstructive jaundice. MRCP allows better lesion characterization and assessment. However, the patchy availability of MR machines become the main achilles heel for the surgeons as well as the radiologists. Hence the valuable role of the omnipresent ultrasonography become immense.

**KEYWORDS :** obstructive jaundice, MRCP, Ultrasonography

### INTRODUCTION

The word "jaundice" comes from French word jaune, which means yellow due to the yellowish discoloration of skin, sclera, and mucous membrane seen in jaundice caused by bilirubin pigment.<sup>(1)</sup> It is broadly divided in to two forms obstructive(surgical) and non- obstructive (non-surgical). Obstructive jaundice involves obstruction to the passage of conjugated bilirubin from liver cells to intestine and presents as a challenging condition to the surgeon because of the high morbidity and mortality associated with it. Hence preoperative evaluation of obstructive jaundice becomes important to know the cause, extent and level of obstruction for proper management and choice of appropriate procedure.

Hepatobiliary obstruction can be benign and malignant. With benign causes including conditions such as choledocholithiasis, primary sclerosing cholangitis, AIDS cholangiopathy, postsurgical stricture. Malignant causes include cancers of biliary tract, pancreas and duodenum.

The eastern India has a high case load of cholelithiasis, choledocholithiasis and cancer gall bladder there by making these cases and their evaluation an essential part for both surgeons and radiologists working in these regions. The non-invasive radiological modalities which are now work horse investigation for obstructive jaundice basically include ultrasonography and magnetic resonance cholangiopancreatography.

The cystic nature of both the gallbladder and the bile ducts, particularly when dilated, provides an inherently high contrast resolution in comparison to the adjacent tissue for sonography, and the acoustic window provided by the liver allow for a high-quality examination in the majority of patients.

MRCP is an excellent imaging technique for evaluating biliary and pancreatic pathologies because it has high soft tissue contrast that enables excellent characterization of masses. It allows direct visualization of biliary ducts and provides images similar to ERCP and percutaneous transhepatic cholangiography<sup>7</sup>. MRCP uses magnetic resonance imaging to visualize fluid in the biliary and pancreatic ducts as high signal intensity on heavily T2-weighted sequences. The specific advantages of MRCP are that it is non-invasive, there is no

radiation exposure, no requirement of anaesthesia. It is not operator dependent. It Allows better visualization of ducts proximal to an obstruction. When combined with conventional T1- and T2- weighted sequences, allows detection of extra-ductal diseases. It can also help in differentiating benign and malignant stricture. However, the reporting and availability of MRCP is not as simple and as easily available as that of a ultrasonography.

### AIM AND OBJECTIVE

To evaluate patients of obstructive jaundice by sonography and magnetic resonance cholangiopancreatography and compare the reporting and findings by both the modalities.

### MATERIALS AND METHODS

This study started after taking all necessary permissions from the institutional ethics committee of Patna Medical College and Hospital. The due permissions from the Head of Department of Surgery and from the Head Department of Radiology were also taken.

The study was conducted at the Department of Radiodiagnosis, Patna medical College and Hospital.

The patients evaluated, were referred for investigation for obstructive jaundice by the Department of Surgery Patna Medical College and Hospital.

**STUDY DESIGN-** Cross sectional observational study.

**STUDY DURATION-** November 2018 to October 2020

**SAMPLE SIZE-** The study consists of 32 patients who had clinical jaundice and consented to being subjected to both ultrasound and MRCP.

### METHODOLOGY-

Abdominal sonography will be done using 3-5MHz transducer. MRCP-The Following MR sequences were performed on Siemens MR scanner

- T2 HASTE sequence in transverse and coronal plane
- T1 sequence -pre- and post-gadolinium
- 3D SEQUENCE /Any other sequence required specific to the case

The ultrasound and MRCP features of site and level of obstruction and cause of obstruction were evaluated. Study was analysed per standardized statistical methods.

**OBSERVATIONS**

The study population consisted of 32 patients of suspected biliary obstruction who were subjected to ultrasonography and MRCP for the same. The age of patients ranged from 7-85 years with maximum numbers of patients (16) in 5-6<sup>th</sup> decade (50%). 20(62%) were females and 12(38%) were males.

**1. INTRA AND EXTRAHEPATIC BILIARY RADICAL DILATATION**  
 Intrahepatic biliary radical dilatation was found in all 32 patients. Both USG and MRCP were able to identify intrahepatic biliary radical dilatation. Extrahepatic bile duct dilatation was found in 25 (78.1%) patients while normal extrahepatic bile duct was found in 7(21.8%) patients. Both USG and MRCP were able to detect extrahepatic CBD dilatation equally in 25 patients.

**2. PRESENCE OF INTRAHEPATIC/HILAR MASS CAUSING BILIARY OBSTRUCTION**

In our study population of 32 patients, in 5(15.6%) patients USG demonstrated intrahepatic mass causing obstruction at the level of confluence of right and left hepatic duct or CHD. MRCP demonstrated the same but the characterization of mass was found to be better on MR images.

**3. PRESENCE OF INTRINSIC CBD MASS**

Ultrasonography was able to detect the intrinsic mass of the extrahepatic common bile duct in 2(6.2%) patients out of 32 patients in our study population. MRCP could detect the same in 6(18.7%) patients. All the findings were further confirmed by histological analysis.

**4. PRESENCE OF BILE DUCT NARROWING (STRICTURE) IN OBSTRUCTIVE JAUNDICE**

In our study narrowing of CBD with stricture formation and upstream dilatation of biliary tree was identified in 10(31.2%) patients on MRCP. Ultrasound could diagnose the same in one patient. Out of these 10 patients 7(21.8%) were categorized as malignant stricture and 3(9.3%) were categorized as benign stricture based on the radiological appearance of narrowed segment.

**5. EXTRINSIC EXTRAHEPATIC BILIARY OBSTRUCTION**

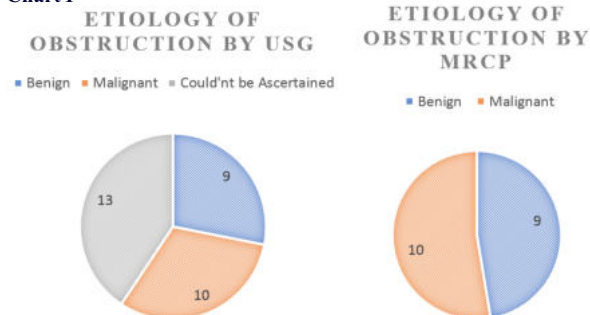
Extrinsic compression of extrahepatic bile duct leading to biliary obstruction was found in 3(9.3%) patients. Mass of pancreatic head in 2(6.2%) patients while a large pseudocyst in the lesser sac was the cause of obstruction in 1 patient. Both USG and MRCP were able to detect pancreatic head mass as well as pseudocyst.

**6. DIAGNOSIS OF ETIOLOGY OF OBSTRUCTIVE JAUNDICE BY MRCP VIS A VIS ULTRASONOGRAPHY**

In our study, in each of the 32 patients both USG and MRCP were evaluated to identify etiologies of obstruction. Results were correlated with ERCP or histopathology findings which ever applicable.

On MRCP 15(46.8%) patients were found to have benign etiology of obstructive jaundice and 17(53.1%) patients had malignant etiology of obstructive jaundice. Out of 32 patients, ultrasound could visualise the cause of biliary obstruction in 19(59.3%) patients. Of these 19 patients USG findings identified 10 patients with malignant etiology and 9 patients with benign etiology. In 13 patients USG failed to identify an etiology of obstruction.

**Chart 1**



**BENIGN CAUSES**

Ultrasound diagnosed choledocholithiasis in 6(18.7%) patients while MRCP diagnosed choledocholithiasis in 9 patients. Choledocholithiasis was confirmed by ERCP in these 9 patients. Choledocholithiasis was missed in 3(9.3%) patients on ultrasonography. Narrowing of CBD/CBD with stricture formation was not identified on USG while MRCP identified short segment smooth tapering of CBD/CHD in 3 patients which was therefore categorized as benign. Intrahepatic hydatid cyst, choledochal cyst and pseudocyst of pancreas were etiologies that could be detected on sonography as well as on MRCP.

**Table-1**

ETIOLOGY OF OBSTRUCTION	USG	MRCP	TOTAL
CHOLEDOCHOLITHIASIS	6	9	9
BENIGN BILIARY STRICTURE	0	3	3
CHOLEDOCHAL CYST	1	1	1
HYDATID CYST	1	1	1
PANCREATIC PSEUDOCYST	1	1	1
TOTAL	9	15	15

**MALIGNANT CAUSES**

Of the 17(53.1%) patients diagnosed to have malignant etiology of obstructive jaundice, abdominal ultrasound was able to detect malignant etiology of obstructive jaundice in 10(31.2%) patients while MRCP could detect malignant etiology in all 17(53.1%) patients. In 4 patients mass involving the intrahepatic confluence of ducts or extrahepatic CBD mass was detected on USG (etiology diagnosed in these 4 patients was cholangiocarcinoma). In 4 patients USG detected mass in the gall bladder (12.5%). Mass in head of pancreas was identified in 2 patients on USG. Thus, on USG, out of 32 patients in the study population 10 patients were diagnosed with malignant etiology of obstructive jaundice.

**Table-2**

MALIGNANT CAUSE OF OBSTRUCTION	USG	MRCP	TOTAL
CARCINOMA OF HEAD OF PANCREAS	2	2	2
HILAR CHOLANGIOCARCINOMA	2	2	2
CHOLANGIOCARCINOMA (EXTRAHEPATIC CBD)	2	6	6
CARCINOMA OF GALL BLADDER	4	5	5
CARCINOMA OF AMPULLA OF VATER	0	1	1
DUODENAL CARCINOMA	0	1	1
TOTAL	10	17	17

**STATISTICAL ANALYSIS**

Statistical software (SPSS version 22) was used for the statistical analyses. All the variables were tested for normality using Kolmogorov-Smirnov test.

**SENSITIVITY AND SPECIFICITY OF USG AND MRCP IN EVALUATION OF INTRAHEPATIC AND EXTRAHEPATIC BILIARY DUCT DILATATION**

In our study, the sensitivity positive predictive value and diagnostic accuracy of both USG and MRCP to identify IHBRD in patients of obstructive jaundice was 100%.

**Table-3**

IHBRD	MRCP			Sensitivity	Specificity	PPV	NPV	Accuracy
	Present	Absent	Total					
USG	Present	32 (100%)	0 (0%)	100	-	100	-	100
	Absent	0 (0%)	0 (0%)					
	Total	32 (100%)	0 (0%)					

In our study, sensitivity of both USG and MRCP to identify CBD dilatation was 100% with 100% specificity. The PPV, NPV and diagnostic accuracy of both USG and MRCP was 100%.

**Table-4**

CBD	MRCP			Sensitivity	Specificity	PPV	NPV	Accuracy
	Dilated	Not dilated	Total					
USG	Dilated	25 (100%)	0 (0%)	100	100	100	100	100
	Not dilated	0 (0%)	7 (21.9%)					
	Total	25 (100%)	7 (100%)					

**SENSITIVITY/SPECIFICITY/PPV/NPV OF USG AND MRCP FOR DETECTION OF BENIGN AND MALIGNANT ETIOLOGY**

**TABLE-5**

ETIOLOGY	Diagnostic modality	Sensitivity	Specificity	PPV	NPV	Accuracy	p value
Malignant	USG	58.8	60	62.5	56.3	59.4	<0.01
	MRCP	100	100	100	100	100	<0.01
Benign	USG	60	58.8	56.3	62.5	59.4	<0.01
	MRCP	100	100	100	100	100	<0.01

## SENSITIVITY/SPECIFICITY/PPV/NPV TO IDENTIFY MALIGNANT ETIOLOGY

Table-6

Malignant causes	Diagnostic modality	Sensitivity	Specificity	PPV	NPV	Accuracy
Carcinoma of head of pancreas	USG	100	100	100	100	100
	MRCP	100	100	100	100	100
Hilar cholangiocarcinoma	USG	100	100	100	100	100
	MRCP	100	100	100	100	100
Cholangiocarcinoma	USG	33.3	100	100	73.3	76.5
	MRCP	100	100	100	100	100
Carcinoma of gall bladder	USG	80	100	100	92.3	94.1
	MRCP	100	100	100	100	100

## SENSITIVITY, SPECIFICITY, PPV, NPV AND DIAGNOSTIC ACCURACY OF USG AND MRCP TO DETECT CHOLEDOCHOLITHIASIS

Table-7

Benign causes	Diagnostic modality	Sensitivity	Specificity	PPV	NPV	Accuracy
Choledocholithiasis	USG	66.7	100	100	66.7	80
	MRCP	100	100	100	100	100

## DISCUSSION

Obstructive jaundice is cause of significant morbidity in patients and early diagnosis of the cause of jaundice and the level of obstruction is of paramount importance to institute timely therapeutic intervention. Ultrasonography is regarded as the primary mortality for diagnosis of obstructive jaundice. However, MRCP has emerged as a better diagnostic tool for evaluation of obstructive jaundice.

In our study population intrahepatic biliary radical dilatation was found in all 32(100%) patients of obstructive jaundice. Both USG and MRCP were able to identify intrahepatic biliary radical dilatation in 100% patients. Dewbury KC et al<sup>3</sup> evaluated ductal dilatation by USG with 97% sensitivity, and Goyani B et al<sup>4</sup>, could detect intrahepatic ductal dilatation with 100% sensitivity. In our study MRCP could differentiate surgical jaundice from medical jaundice by evaluating the intrahepatic biliary radical dilatation with 100% sensitivity which was similar to studies conducted by Goyani B et al<sup>4</sup> and Al Obaidi et al<sup>5</sup> who found that MRCP could differentiate surgical jaundice from medical jaundice with 100% sensitivity.

In our study CBD dilation was found in 27 patients. In our study sensitivity of both USG and MRCP to identify CBD dilatation was 100% and specificity was 100%. The 5 patients in which CBD was not dilated had obstruction predominantly involving the confluence of right and left hepatic duct or common hepatic duct due to various etiologies. 2 of the intrahepatic masses were diagnosed based on USG and MRCP findings to be hepatic invasion from gall bladder carcinoma into segment IV and V involving the confluence of right and left hepatic ducts, 2 masses were diagnosed as hilar cholangiocarcinoma by their imaging features and 1 patient was diagnosed as hepatic hydatid cyst involving segment V and VIII of liver. All the findings were further confirmed by histological analysis and serology (hydatid cyst).

In terms of detecting extrahepatic CBD mass as a cause of obstruction, MRI was found to be a better modality. Ultrasound detected it in two patients whereas MRI detected the same in six patients.

MRCP diagnosed 10 patients to have stricture of CBD of which 3 patients had a smooth short segment tapering and were diagnosed to be benign while 7 had long segment irregular narrowing and were diagnosed as malignant. On USG narrowing of CBD was identified in 1 patient out of 10 patients. 9 patients of CBD stricture was missed and not diagnosed on USG. The results of our study for diagnosis of stricture /CBD narrowing by ultrasound and MRCP were comparable with those of Al-Obaidi S et al<sup>5</sup>, in which ultrasonography could detect 1 patient with benign stricture out of total of 11 patients while MRCP could detect stricture in 11 patients.

There were three cases of extra hepatic biliary tract obstruction with

the cause being pseudocyst of pancreas (1) and carcinoma head of pancreas (2). In our study there were 2(6.2%) patients with carcinoma of head of pancreas. The sensitivity and specificity of USG as well as MRI were 100% in detecting the mass in head of pancreas with PPV, NPV and diagnostic accuracy of 100%. It was comparable to study by Kushwah AP et al<sup>6</sup>. As far as the lone case of pseudocyst is concerned both USG and MRI were able to detect them.

Out of all 15 benign causes of obstructive jaundice most common cause of obstruction was choledocholithiasis seen in 9(28.1%) patients. The sensitivity, specificity of USG for diagnosing choledocholithiasis was 67.7%, 100% and positive predictive value, negative predictive value and diagnostic accuracy of USG 100%,66.7% and 80% and that for MRCP sensitivity was 100% and specificity was 100%. The positive predictive value and negative predictive value was 100% and 100% with diagnostic accuracy of 100%. In study by Jiwani MS et al<sup>8</sup>, the sensitivity of ultrasound to detect choledocholithiasis was 84.2% while specificity was 88% and the sensitivity and specificity of MRCP was 95.6% and 95.6%. The specificity in our study was higher as compared to Jiwani MS et al<sup>8</sup>. Sensitivity and specificity of MRCP for detecting choledocholithiasis was 100% which was well correlated with Jiwani MS et al<sup>8</sup>. The sensitivity, specificity, PPV and NPV and diagnostic accuracy obtained for ultrasonography in our study were higher than Al-Obaidi S et al<sup>5</sup> however on MRCP the results were comparable with Varghese JC et al<sup>9</sup> and Al-Obaidi S et al<sup>5</sup>.

Out total 17 patients with malignant etiology ultrasound could pick the malignant cause of obstructive jaundice in 10(31.2%) patients 88 while MRCP could detect the cause in all 17(53.1%) patients. USG detected 10 out of 17 cases of malignant etiology of obstructive jaundice with sensitivity, specificity, PPV, NPV, diagnostic accuracy of 58.8%,60%,62.5%,56.3% and 59.4% with p-value <0.01 while sensitivity, specificity, PPV, NPV, diagnostic accuracy of Al-Obaidi S et al were 36.3%,80.7%,70%,68.1% 73.75% which was comparable from our study. Our results were also higher than Kurian JM et al<sup>7</sup>, as they showed sensitivity, specificity PPV, NPV of MRCP as 81.25%,91.66%,81.25%,91.66%.

## CONCLUSION

With this study we can conclude that ultrasonography is the primary modality to screen patients with obstructive jaundice because of the ease of ability and cost effectiveness. However, USG has low sensitivity in identifying strictures of CBD and determining etiology of biliary obstruction, due to certain limitations such as lower spatial resolution, obscuration by excessive bowel gas and inter-operator variability.

We also conclude that MRCP has high sensitivity and specificity in diagnosing etiology of biliary tract obstruction in patients of obstructive jaundice, both benign and malignant. Also, MRCP has high sensitivity and specificity to diagnose the narrowed segment and stricture formation as well as identify its etiology at the same time. Imaging features on MRCP enable differentiation of benign from malignant strictures.

The accuracy of MRCP was found to be comparable to that of ERCP for diagnosis etiology of obstructive jaundice. MRCP allows better lesion characterization and assessment.

However, the patchy availability of MR machines become the main Achilles heel for the surgeons as well as the radiologists.

Herein come valuable role of the omnipresent ultrasonography which is although inferior to MRCP, still gives valuable information regarding obstructive jaundice to the surgeon and radiologists in most of the cases.

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