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A COMPARATIVE STUDY BETWEEN USG AND 3 T-MRCP IN DIAGNOSING PANCREATICO-BILIARY DISORDERS ASSUMING ERCP/HISTOPATHOLOGY AS GOLD STANDARD

Radio-Diagnosis

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ABSTRACT

Background- Evaluation of jaundice patients should include proper history, clinical examination, laboratory investigation, and radiological imaging.

Purpose- To find out the better imaging modality (between USG and MRCP) for accurately diagnosing the cause of Obstructive Jaundice.

Materials And Methods- Our study was a hospital-based Prospective analytical-observational study, conducted in the Department of Radiodiagnosis, SMS hospital Jaipur. Total 50 patients in the age group of 1-85 years with clinically suspected Pancreaticobiliary disorders with altered LFT were included. They underwent ultrasonographic examination followed by MRCP examination. The diagnosis was confirmed by ERCP/ histopathology. The data was compiled and analyzed.

Results: Choledocholithiasis was the most common cause of obstructive jaundice and was seen in 20/50 patients (40%) followed by malignant mass lesions in 15/50 patients (30%) followed by benign lesions in 10/50 (20%) followed by the least common one – choledochal cyst in 5/50.

Conclusion- Ultrasound remains the primary investigative modality of choice. The efficacy of MRCP is comparable to that of ERCP and can be considered as the new gold standard for evaluation of the pancreaticobiliary system.

KEYWORDS

Pancreatico-biliary disorders, USG, MRCP.

INTRODUCTION

In obstructive jaundice, there is blockage of the pathway between the bile conjugation site in the liver and the entry of bile into the duodenum through the ampulla. The biliary path obstruction may be intrahepatic or extrahepatic.[1] The causes can be benign or malignant. Benign conditions include choledocholithiasis, choledochal cyst, Biliary atresia, mirizzi syndrome whereas malignant causes are cholangiocarcinoma, infiltrating GB mass, periampullary carcinoma, Ca head of the pancreas. In extrahepatic causes, the two most common causes are choledocholithiasis and pancreaticobiliary malignancies.[1]

Ultrasound has advantages of rapidity, low cost, wide availability, free of radiation hazard, and visualization of adjacent organs. It can accurately differentiate between liver parenchymal disease and extrahepatic biliary obstruction. Hence, Ultrasound has become the primary screening investigation.[1]

However, USG has some limitations like it is operator dependent and there is difficulty in visualizing the intrahepatic and extrahepatic bile ducts and the pancreas because of overlying bowel gas, obesity, and ribs.[2]

Magnetic resonance cholangiopancreatography (MRCP) consists of heavily T2-weighted sequences, hence, producing remarkable increased contrast between stagnant fluid (bile) and background (abdominal fat, hepatic, pancreatic parenchyma). It has high spatial tissue resolution, has an "All in one" approach (Parenchyma, Ducts, and Vessels), and is a direct multi-planar modality. Also, MRCP has the advantage of combining projectional & cross-sectional images in the evaluation of the biliary system. MRCP readily permits the study of the anatomy and pathology of the pancreaticobiliary system. To achieve heavy T2-weighting, two commonly used techniques include RARE (Rapid Acquisition with Relaxation Enhancement) and HASTE (Half Fourier Single Shot Turbo Spin Echo).[3]

Common indications of MRCP include unsuccessful ERCP, a contraindication to ERCP, and biliary-enteric anastomoses. According to recent studies, MRCP is comparable with invasive endoscopic retrograde cholangiopancreatography (ERCP) in diagnosing extrahepatic biliary duct abnormalities. However, the role of MRCP in the evaluation of intrahepatic bile duct abnormalities is under investigation.[3]

MRCP is better than ERCP in the following ways (a) is non-invasive; (b) radiation-free; (c) cheaper; (d) requires no anesthesia; (e) less operator-dependent; (f) allows better visualization of ducts proximal to an obstruction; and (g) allows detection of extra ductal disease when combined with conventional T1- and T2-weighted sequences.[3] Disadvantages of MRCP include (a)decreased sensitivity for subtle ductal abnormalities when imaged in the physiologic, non-distended state.; (b) less sensitive to abnormalities of the peripheral intrahepatic ducts (e.g., sclerosing cholangitis) and pancreatic ductal side branches (e.g., chronic pancreatitis) and (c) results in delayed appropriate care in patients who need the therapeutic endoscopic or percutaneous intervention for obstructing bile duct lesions.[3]

3T MRCP is better than 1.5T MRCP in the following ways, like MR cholangiopancreatography at 3T enhances image quality, improves SNR twice over that at 1.5 T, and produces higher-resolution image data sets with reduced acquisition time. 3T MRCP suppresses fluid signals in the gastrointestinal tract more effectively, so there is better visualization of the hepatobiliary and pancreatic ducts. 3T MRCP shows the relation of the pancreatic parenchyma to the ductal system in a better way in comparison to 1.5 T, especially visualization of side branches is improved at 3T. Furthermore, 3T MRCP detects distal arborization and intrahepatic bile duct variation more easily.[1]

In this study, we intend to evaluate the diagnostic accuracy of USG and 3T MRCP, as there is no available literature to date, for comparing these two non-invasive, non-ionizing, indirect techniques in obstructive jaundice.

MATERIALS AND METHODS

Our study was a hospital-based Prospective analytical-observational study, conducted in the Department of Radiodiagnosis, SMS hospital Jaipur. Total 50 patients in the age group of 1-85 years with clinically suspected pancreaticobiliary disorders with altered LFT were included. Uncooperative patients were excluded. Selected patients underwent ultrasonographic examination on Hitachi ultrasound machine followed by MRCP examination on 3 Tesla MRI Philips Ingenia machine.

***Ultrasound Technique*:**

Patients were examined after a fasting period of a minimum of 6 hours. Detailed examination of the liver, gall bladder, biliary radicals, pancreas, and adjacent organs was carried out using a curvilinear low frequency (3-5MHz) probe.

***MRCP Technique*:**

Patients underwent MRCP examination following 6 hours fasting, preferably overnight. The patients were placed on the MR table in a supine position with arms placed above the head and they were

explained to stay still and avoid movements. All patients were subjected to a detailed MR examination using appropriate MRI protocol.

MRI Protocol:

Parameter	Coronal T2 TSE	AXIAL T2 TSE	3D MRCP	CORONAL FS	AXIAL FS
Repetition time(ms)	627	635	3740		
Echo time(ms)	80	80	740		
Breath hold time(secs)			20		
Slice thickness(mm)	3.3	3.3	3.3		
Inter-slice gap	0	0	0		
Field of view(FOV)(mm) AP RL FOOT TO HEAD	 340 340 108	 350 350 117	 277 277		
FLIP ANGLE(DEGREE)			8		
Matrix	216x191	252x202	296x237		
Acquisition time (mins)	3.54	3.6	1.14		

RESULTS

The maximum number of patients were in the 61-80 years of age group i.e., 20/50 (40%) (Table 1). Out of 50 patients with pancreaticobiliary pathologies, 27 patients (54%) were females and 23 patients (46%) were males. The male: female ratio in the study was 0.8:1(Table 2). Choledocholithiasis was the most common cause of obstructive jaundice and was seen in 20/50 patients (40%) followed by malignant mass lesions in 15/50 patients (30%) followed by benign lesions in 10/50 (20%) followed by the least common one – choledochal cyst in 5/50 (10%) (Table 3).

The sensitivity and specificity of ultrasonography in detecting benign lesions were 71.43% and 73.33% with a positive predictive value of 86.2%, a negative predictive value of 52.38%, and an accuracy of 72%. The sensitivity and specificity of MRCP in detecting benign lesions were 91.43% and 86.67% with a positive predictive value of 94.12%, a negative predictive value of 81.25%, and an accuracy of 90% (Table 6).

The sensitivity and specificity of ultrasonography in detecting malignant lesions were 86.67% and 97.14% with a positive predictive value of 92.86%, a negative predictive value of 94.44%, and an accuracy of 94%.

The sensitivity and specificity of MRCP in detecting malignant lesions were 93.33% and 100 % with a positive predictive value of 100 %, a negative predictive value of 97.22%, and an accuracy of 98% (Table 7).

Table 1: Distribution Of Patients According To Age Group

S.NO	AGE (YEARS)	NO. OF PATIENTS	PERCENTAGE %
1.	1- 20 y	5	10%
2.	21- 40 y	7	14%
3.	41- 60 y	14	28%
4.	61- 80 y	20	40%
5.	81- 85y	4	8%
	TOTAL	50	100%

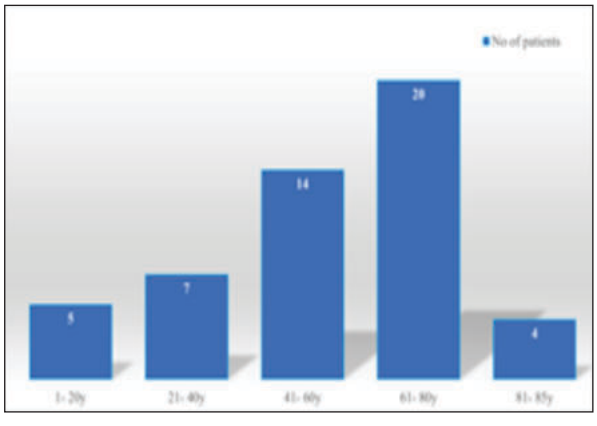

Table 2: Distribution of Patients According to Sex

SEX	NO. OF CASES	PERCENTAGE (%)
MALES	23	46%
FEMALES	27	54%
TOTAL	50	100%

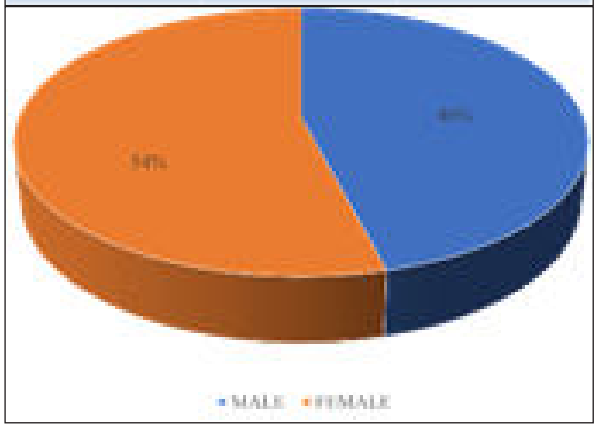

Table 3: Distribution Of Patients Based On Cause Of Obstruction

S No	CAUSES OF OBSTRUCTION	NO OF PATIENTS	%
1.	Choledocholithiasis	20/50	40 %
2.	Malignant mass lesions	15/50	30%
	Hilar carcinoma		
	Distal CBD carcinoma		
	Infiltrating GB mass		
	Ca head of pancreas		
	Peri-ampullary carcinoma		
	Malignant lymph node		
3.	Benign stricture	10/50	20%
4.	Choledochal cyst	5/50	10%
	Total	50	

Table 4: Diagnostic Performance Of USG For Different Causes Of Obstructive Jaundice

CAUSE OF OBSTRUCTION	TRUE +VE	FALSE +VE	FALSE -VE	TRUE -VE	SENSITIVITY (%)	SPECIFICITY (%)	PPV (%)	NPV (%)	ACCURACY (%)
Choledocholithiasis	15	3	5	27	75%	90%	83.33%	84.38%	84 %
Malignant mass lesions	13	1	2	34	86.67%	97.14%	92.86%	94.44%	94%
Benign stricture	5	1	5	39	50%	97.5%	83.33%	88.64%	88%
Choledochal cyst	5	0	0	45	100%	100%	100%	100%	100%

Table 5: Diagnostic Performance of MRCP for Different Causes of Obstructive Jaundice

CAUSE OF OBSTRUCTION	TRUE +VE	FALSE +VE	FALSE -VE	TRUE -VE	SENSITIVITY (%)	SPECIFICITY (%)	PPV (%)	NPV (%)	ACCURACY (%)
Choledocholithiasis	18	1	2	29	90%	96.67%	94.74%	93.55%	94%
Malignant mass lesions	14	0	1	35	93.33%	100%	100%	97.22%	98%
Benign stricture	9	1	1	39	90%	97.5%	90%	97.5%	96%
Choledochal cyst	5	0	0	45	100%	100%	100%	100%	100%

Table 6: Diagnostic Performance Of USG And MRCP In Detecting Benign Lesions

MODALITY	SENSITIVITY (%)	SPECIFICITY (%)	PPV (%)	NPV (%)	ACCURACY
USG	71.43%	73.33%	86.2%	52.38%	72%
MRCP	91.43%	86.67%	94.12%	81.25%	90%

Table 7: Diagnostic Performance of USG And MRCP in Detecting Malignant Lesions

MODALITY	SENSITIVITY (%)	SPECIFICITY (%)	PPV (%)	NPV (%)	ACCURACY
USG	86.67%	97.14%	92.86%	94.44%	94%
MRCP	93.33%	100%	100%	97.22%	98%

Case 1- Cholelithiasis With Choledocholithiasis

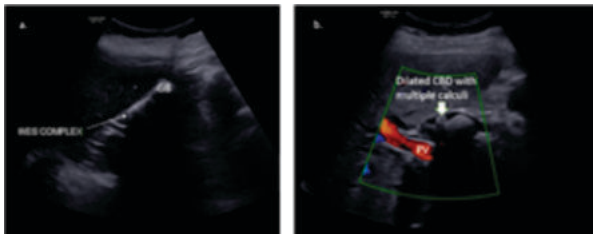

Figure 1: A 40 years old female patient presented with complaint of right sided pain abdomen. USG shows multiple echogenic foci with distal acoustic shadow in Gall bladder and CBD.

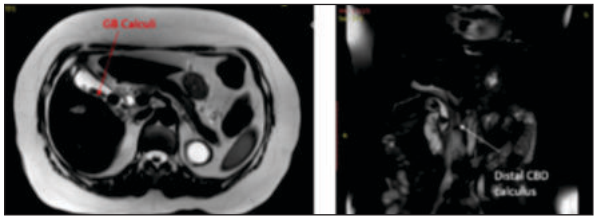

Figure 2: MRCP Shows Multiple Filling Defects Are Noted In GB Lumen And Distal CBD s/o Cholelithiasis With Choledocholithiasis. Further, ERCP Guided Removal Of Calculi Was Done.

Case 2- Klatskin Tumour

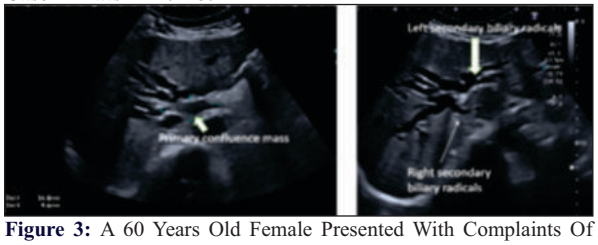

Figure 3: A 60 Years Old Female Presented With Complaints Of Jaundice And Loss Of Appetite. USG Images Show An Ill-defined Hypoechoic Mass Lesion At Primary Biliary Confluence Causing Dilatation Of Secondary (right And Left) Biliary Radicals.

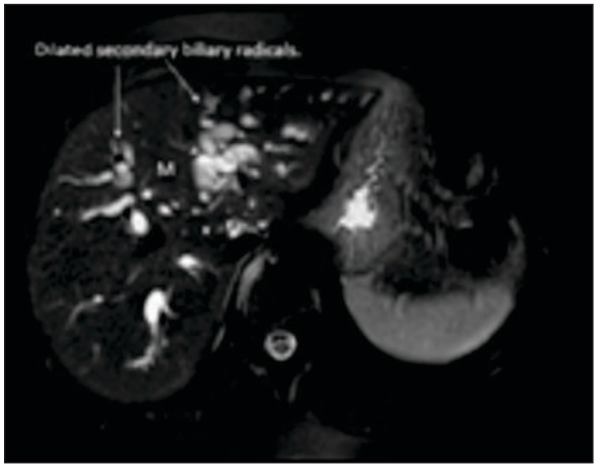

Figure 4: MRCP Shows An Ill-defined Isointense Mass Lesion (M) At Primary Biliary Confluence Causing Abrupt Cut-off Of Right And Left Secondary Biliary Radicals. FNAC Was Done And Histopathology Confirmed The Diagnosis Of Cholangiocarcinoma.

Case 3: Choledochal Cyst –Type I

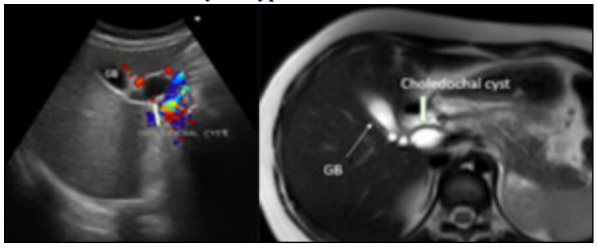

Figure 5: A 14 years old girl presented with complaints of right sided abdominal pain and vomiting; USG (left image) and MRCP (right image) shows a fusiform dilatation of CBD

DISCUSSION

In our study, 50 patients suffering from pancreaticobiliary pathologies were studied. The maximum number of patients were in 61-80 years of age group i.e., 20/50 (40%), followed by 14/50 (28%) in 41-60 years age group, followed by 7/50 (14%) in 21-40 years age group, followed by 5/50 (10%) in 1-20 years age group. A study done by Siva Prasad A et al.[6] shows that the peak incidence of Biliary diseases (62%) was seen in the age group of >40 years. A study conducted by Kushwah et al.[5] shows that out of 50 patients majority of the cases were found in the 51-60 years age group. There was female preponderance. Out of 50 patients, 27 patients (54%) were female and 23 patients (46%) were male. Male: Female ratio being 0.8:1. A study done by Siva Prasad A et al.[6] shows female preponderance. Out of 50 patients, 33 patients (66%) were female and 17 patients (34%) were male. Male: female ratio being 1:1.9. A study conducted by Kushwah et al.[5] shows that out of 50 patients, 30 patients (60%) were female and 20 patients (40%) were male.

In the present study, benign pathologies were more common as compared to malignant pathologies. Out of 50 patients, 35 patients (70%) had benign pathologies and 15 patients (30%) had malignant pathologies. The most common benign pathology was choledocholithiasis in 20 patients (40%). A similar study conducted by Gajbhiye et al.[8] shows that the number of benign pathologies was more than malignant pathologies. Out of 75 patients, 49 patients (65.4%) had benign pathology and 22 patients (29.3%) had malignant pathology and findings were normal in 4 patients.

In our study, Cholangiocarcinoma comprised the maximum number of malignant cases- 10 (66.7%). Accuracy for malignant pathologies on USG was 100% for carcinoma GB, 66.7% for periampullary mass, 100% for Klatskin tumor. Accuracy for malignant pathologies on MRCP was 100% for carcinoma GB, 83.3% for periampullary mass, 100% for Klatskin tumor. This result can be compared with the study of Kurian et al.[7] In our study, as a cause of obstruction among malignant lesions, USG was found 86.67% sensitive and 97.14% specific and MRCP was 93.33% sensitive and 100 % specific. Results were in concordance with a study by Kushwah et al.[5] in which among malignant lesions as a cause of obstruction, USG was found 94.1% sensitive and 68.7% specific, and MRCP was 97% sensitive and 93.7% specific.

In our study, as a cause of obstruction among benign lesions, the most common benign cause of obstructive jaundice was choledocholithiasis (20 patients), followed by Benign stricture in 10 patients and the least one is a choledochal cyst in 5 patients. The result can be compared with a study by Kushwah et al.[5] The accuracy for benign obstructive pathologies on USG was 75% for choledocholithiasis, 100% for the congenital anomaly (choledochal cyst), 50% for benign biliary stricture. The accuracy of MRCP for benign obstructive pathologies was 90% for choledocholithiasis, 100% for the congenital anomaly, 90% for benign biliary stricture. This result can be compared with the study of Kushwah et al.[5]

CONCLUSION

Based on our study results, the following conclusions can be made- Ultrasound remains the primary investigative modality of choice. So, in patients of suspected biliary and pancreatic pathology, USG is the first and foremost primary imaging modality of choice. It not only confirms the diagnosis of obstructive jaundice by visualizing the dilated biliary system but also guides us further by narrowing down the diagnoses and to which investigation the patient must be further subjected. However, it has less diagnostic accuracy in the evaluation of benign, malignant stricture of the lower end of CBD, calculi in the lower end of CBD, congenital anatomical variants, post-operative biliary tree anatomy, and pathology.

MRCP has almost 98% diagnostic accuracy. It serves as a more sensitive, specific, accurate, and non-invasive, non-ionizing imaging modality for evaluation of pancreaticobiliary anatomy and pathology and allows safe surgical management decisions by accurately providing preoperative staging of patients with malignant pathology. Also, it is a very useful tool in the case of obese patients and children (where USG has difficulty in visualization). MRCP is potentially useful in patients undergoing biliary enteric anastomosis for knowing

the level and extent of strictures.

The efficacy of MRCP is comparable to that of ERCP and can be considered as the new gold standard for evaluation of the pancreaticobiliary system. So, all those patients who have biliary and pancreatic pathology, not diagnosed by USG and laboratory features suggestive of with strong clinical suspicion must be evaluated by MRCP for diagnostic accuracy.

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