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The Role of MRCP in Evaluation of Pancreatic and Biliary Pathologies in Correlation with ERCP

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Abstract

***Background**: Diagnosis of pancreaticobiliary pathologies is often required for their successful management. The current study aims to determine hepatobiliary and pancreatic pathologies on MRCP and in deciding further course of management. To evaluate the efficacy of MRCP in detecting biliary tract abnormalities compared to ERCP. **Methods**: This cross-sectional observational study was conducted in the Department of Radiology, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. MRI-MRCP: was performed on Philips ACHIEVA 1.5 Tesla MRI Scanner in the supine position using a phased-array body coil. ERCP was performed with Olympus type 150 scope, to decompress the biliary system was done by an experienced gastroenterologist after MRI examination. **Results:** The overall sensitivity, specificity, PPV, and NPV of all pancreaticobiliary lesions. MRCP revealed a Sensitivity of 97.73 % Specificity was 83.33 % Positive Predictive Value (PPV) was 97.73 %, Negative Predictive Value (NPV) was 83.33 %. In ERCP the Sensitivity was 77.27% Specificity was 66.67%. Positive Predictive Value (PPV) was 97.44 %, Negative Predictive Value (NPV) was 28.57%. **Conclusion:** MRCP has more sensitivity, specificity, and diagnostic accuracy than ERCP in diagnosing obstruction due to pancreaticobiliary disorders. MRCP can determine accurately more cases than ERCP in both cause and extent of obstruction. The anatomy of the biliary tree is well delineated by MRCP. Bile ducts proximal as well as distal to the level of obstruction are made out better by MRCP. Due to invasiveness and contrast media-induced allergic reactions, diagnostic usage of ERCP is limited.*

***Keywords**: Magnetic resonance cholangiopancreatography (MRCP), Endoscopic cholangiopancreatography (ERCP), pancreaticobiliary pathologies.*

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Introduction

Pancreaticobiliary pathologies include a wide spectrum of diseases like congenital anomalies, choledocholithiasis, strictures, tumors, and inflammatory cholangitis. [1] Clinically the patients may present with pain abdomen, obstructive jaundice, or in some cases may be asymptomatic. The commonly used diagnostic modalities for such disorders include Ultrasonography (USG), Computerized Tomography (CT), Magnetic resonance cholangiopancreatography (MRCP), and invasive procedures like endoscopic cholangiopancreatography (ERCP). Evaluation of patients with bile duct obstruction frequently involves the step-wise performance of several imaging techniques. These investigations aim to provide sufficient diagnostic and anatomic information to allow appropriate treatment. Such information includes the level and cause of biliary obstruction. [2] MRCP is a non-invasive and safe alternative to diagnostic ERCP for imaging the biliary tree and investigating biliary obstruction. MRCP was developed in 1991 since then it has improved progressively it involves

selective fluid-sensitive MRI of the pancreatic and biliary ducts. [3] 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 Cholangiopancreatography with its inherent high contrast resolution, rapidity, multiplanar capability, and virtually artifact-free display of anatomy and pathology, is proving to be imaging of choice in these patients. [4] A disadvantage of MRCP is that it is not a therapeutic procedure, whereas ERCP is used for diagnosis and treatment. ERCP is still the gold standard for the exploration of the pancreaticobiliary region. [5] However, it requires direct cannulation of the common bile duct or pancreatic duct, sedation, the use of ionizing radiation. In addition, ERCP is associated with significant complication rates of 1-7%, such as hemorrhage, sepsis, pancreatitis, and bile leak, as well as recognized mortality of up to 1%. However, if no therapeutic intervention is found to be necessary, MRCP avoids the potential morbidity and mortality associated with ERCP. [6] MRCP is particularly useful where ERCP is difficult, hazardous, or impossible. These investigations aim to provide sufficient diagnostic and anatomic information to allow appropriate treatment. Accurate methods for detecting bile duct and pancreatic duct abnormalities in patients with obstructive jaundice are important to both surgeons and endoscopists. The purpose of the present study is to, describe the features of hepatobiliary and pancreatic pathologies on MRCP and in deciding further course of management and to evaluate the efficacy of MRCP in detecting biliary tract abnormalities compared to ERCP.

Materials and Methods

This cross-sectional observational study was conducted in the Department of Radiology, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical committee permission was obtained for the study. Written consent was obtained from all the participants of the study.

Inclusion criteria

1. Patients suspected of pancreaticobiliary diseases
2. Pain the abdomen
3. Males and females
4. Aged above 20 years.

Exclusion criteria

1. Patients in whom both techniques were not used for comparison
2. Those who do not fit as per inclusion criteria

Patient preparation for MRI with MRCP:

All the patients were instructed to fast for 6 hours before the examination. All the metallic belongings were removed before the examination. In few uncooperative and critically ill patients, respiratory triggering was used.

***MRI-MRCP*:** was performed on Philips ACHIEVA 1.5 Tesla MRI Scanner in supine position using a phased-array body coil. No contrast was administered within the body. Fasting for 4 hours before the examination is required to reduce gastroduodenal secretions, reduce bowel peristalsis (and related motion artifact), and promote distention of the gallbladder. The patient was given concentrated pineapple juice (or) oral iron oxide approximately 100 ml before the scan. As it can be used as a negative oral contrast agent for gastrointestinal tract signal suppression during MRCP and for improving visualization of various pancreaticobiliary structures. All protocols obtain heavily T2-Weighted sequences. The most obtained sequences are RARE, HASTE, FRFSE, and fat-suppressed T1 GRE sequence.

Secretin-stimulated MRCP (Modified MRCP technique):

When given as a synthetic agent intravenously (1 ml/10 kg body weight), it improves the visualization of the pancreatic duct by increasing its caliber. Pancreatic juice flows out of the major duodenal papilla to progressively fill the duodenum. We perform a thick slab MRCP in the coronal oblique plane at baseline and then at intervals of 1, 3, 5, 7, and 9 minutes following injection. Its effect starts almost immediately and peaks between 2 to 5 mins. By 10 min, the caliber of the main pancreatic duct should return to baseline with persistent dilatation of >3 mm considered abnormal. All

images were obtained with breath-holding and parameters were individualized to optimize each for a suspended breath-hold of about 15 sec.

ERCP Technique: Patients are advised not to take any solid food for 8 hours and liquids for 6 hours before the examination as it was an invasive procedure and the patient is sedated with anesthesia before the examination. Patients with suspected cholangitis are given antibiotic prophylaxis with 1 gm ceftriaxone 1 hr before ERCP and 1 gm ceftriaxone bd, amikacin 500mg bd, or metrogyl 500 mg 8hrly for the next 5 days. ERCP was performed with Olympus type 150 scope, to decompress the biliary system was done by an experienced gastroenterologist after MRI examination. Cholangiogram was obtained in all patients by injecting Omnipaque (350 mg/ml). The contrast agent allows seeing the bile ducts, the gall bladder, and the pancreatic duct on the X-rays. This study included n=50 patients, Data was analyzed using Statistical Package for the Social Science (SPSS) Version 16.00 for Windows. Descriptive (frequencies, Percentages, Mean and Standard Deviation) and inferential statistics were used to analyze the data. The inferential statistics used included Chi-square, analysis of Variance, correlation coefficient. Continuous variables were presented as mean ± (SD). Continuous variables were compared through student independent t-test, Categorical variables by chi-square test were done where applicable. Sensitivity, specificity, PPV, NPV, Accuracy was also calculated in comparing diagnosis. For all statistical tests, P <0.05 was considered statistically significant.

Results

Out of the total n=50 cases included in the study, n=30(60%) cases were male and n=20(40%) were females. The age range was between the age of 24 to 60 years with a mean age was 43.56 ± 8.49 years. The mean age of the whole group was 43.56 ± 8.49. Males had a mean age of (43.82 ± 7.92) and Females had a mean age of 43.23 ± 9.35. There are no significant differences between the age of the male and female (t=0.243 P >0.05) given in table 1.

Table 1: Age-wise distribution of cases in the study

Age Group	*Male*		*Female*		*Total*	
	Frequency	*%*	*Frequency*	*%*	*Frequency*	*%*
20- 30	2	6.7	3	15.0	5	10.00
31- 40	10	33.3	5	25.0	15	30.00
41- 50	10	33.3	8	40.0	18	36.00
51- 60	8	26.7	4	20.0	12	24.00
Total	30	100	20	100	50	100
Chi Square= 1.48 p=0.68 (Not Significant)						

The common clinical complaint in n=22 (44 %) was of obstructive Jaundice, followed by n=21 (42 %) had Pain Abdomen and a small n=7 (14 %) had Cholangitis. The male and female patients differ with regards to their complaints p-value was < 0.04 which is considered significant depicted in table 2.

Table 2: Clinical complaints of cases on Presentation

Complains	*Male*		*Female*		*Total*	
	Frequency	*%*	*Frequency*	*%*	*Frequency*	*%*
Obstructive Jaundice	13	43.3	9	45.0	22	44.00
Pain Abdomen	10	33.3	11	55.0	21	42.00
Cholangitis	7	23.3	0	0	7	14.00
Total	30	100	20	100	50	100
Chi Square= 6.42 df=2 p=0.04* (Significant)						

The MRCP type of causes revealed n=13 (26%) was found to be Stricture, n=06 (12%) was found to be Tumours, Calculus found in n=15 (30%), Cyst and Extrinsic Causes are having each n=5 (10%) and n=6 (10%) was found not having any disease (Not Determined)

Table 3: MRCP based on Cause of obstruction

Cause of Obstruction	*Male*		*Female*		*Total*	
	(n)	*%*	*(n)*	*%*	*(n)*	*%*
BS-PC -Benign Stricture - Post Cholecystectomy	2	6.7	5	25	7	14.0
C-CA -Cholangio Carcinoma	1	3.3	1	5	2	4.00
CC-CBD Calculus	7	23.3	3	15	10	20
CH-P-Chronic Pancreatitis	3	10.0	0	0	3	6.00
Ch-Cy -Choledochal Cyst	2	6.7	3	15	5	10.0
G-CA -Gall Bladder Carcinoma	1	3.30	0	0	1	2.00
GC+CC-GB Calculus + CBD Calculus	3	10.0	2	10	5	10.0
MI-SY -Mirizzi syndrome	2	6.7	0	0	2	4.00
MS-KT -Malignant Stricture – Klatskin Tumour	3	10.0	1	5	4	8.00
PA-CA - Pancreatic Carcinoma	1	3.3	0	0	1	2.00
PC- Periampullary carcinoma	1	3.3	1	5.0	2	4.00
PS-CH-Primary Sclerosing Cholangitis	1	3.30	1	5.0	2	4.00
Normal	3	10.0	3	15.0	6	12.0
Total	30	100	20	100	50	100

The ERCP was able to detect Calculus in n=17(34 %) cases, Stricture in n=11 (22%) cases, Tumors in n=5 (10 %) cases, Cyst in n=5 (10 %) cases, Extrinsic Causes in n=5 (10 %) cases and n=7 (14 %) were free from disease.

The intra-operative findings irrespective of their sex revealed n=5 (10%) are having Malignant stricture with Klatskin Tumour, n=6 (12%) are having Benign Stricture due to Post Cholecystectomy, n=2 (4%) are having Periampullary carcinoma, n=5 (10%) are having

Choledochal Cyst, n=1 (2%) are having Gall Bladder Carcinoma, n=3 (6%) are having Chronic Pancreatitis, n=5 (10%) are having GB Calculus + CBD Calculus, n=2 (4%) are having Mirizzi syndrome, n=1 (2%) are having Pancreatic Carcinoma, n=2 (4%) is having Cholangio Carcinoma and n=6 (12%) free from disease (Normal). Operative findings confirmed Calculus in n=15 (30 %) cases, Stricture in n=13 (26%) cases, Tumors in n=6 (12%) cases, Cyst in n=5 (10 %) cases, Extrinsic Causes in n=5 (10%) cases and n=6 (12 %) were free from disease.

Table 4: ERCP based cause of obstruction

Cause of Obstruction	*Male*		*Female*		*Total*	
	(n)	*%*	*(n)*	*%*	*(n)*	*%*
BS-PC -Benign Stricture - Post Cholecystectomy	2	6.7	4	20	6	12
C-CA -Cholangio Carcinoma	1	3.3	1	5.0	2	4
CC-CBD Calculus	1	3.3	1	5.0	2	4
CH-P-Chronic Pancreatitis	3	10	0	0	3	6
Ch-Cy -Choledochal Cyst	2	6.7	3	15	5	10
G-CA -Gall Bladder Carcinoma	1	3.3	0	0	1	2
GC+CC-GB Calculus + CBD Calculus	3	10	2	10	5	10
MI-SY -Mirizzi syndrome	2	6.7	0	0	2	4
MS-KT -Malignant Stricture - Klatskin Tumour	3	10	1	5	4	8
PA-CA - Pancreatic Carcinoma	1	3.3	0	0	1	2
PC- Periampullary carcinoma	1	3.3	0	0	1	2
PS-CH-Primary Sclerosing Cholangitis	0	0	1		1	2
Normal	3	10.7	4	20	7	14
Total	30	100	20	100	50	100

The calculation of sensitivity in MRCP was done which revealed Sensitivity was 97.73 % Specificity was 83.33 %Positive Predictive Value (PPV) was 97.73 % Negative Predictive Value (NPV) was 83.33 %. In ERCP the Sensitivity was 77.27% Specificity was 66.67%. Positive Predictive Value (PPV) was 97.44 % Negative Predictive Value (NPV) was 28.57%.

Table 5: Sensitivity of MRCP with perioperative findings

Disease Present	*MRCP*	*Per Operative Findings*	*Total*
Test Positive (Determined)	43	1	44
Test Negative (Not Determined)	1	5	6
Total	44	6	50
ERCP			
Determined	41	2	43
Not Determined	03	4	7
TOTAL	44	6	50

Discussion

Diagnosing patients with suspected hepatobiliary or pancreatic pathologies in their the early stage is most important. Knowledge of the advantages and disadvantages of all techniques is needed to determine the appropriate selection for patients with these pathologies. With the introduction of MR Cholangiopancreatography in addition to conventional MRI, diagnosing biliary and pancreatic ductal pathologies invasive procedures like ERCP can be avoided solely for diagnosis. In this study sensitivity in MRCP was 97.73 % Specificity was 83.33 % Positive Predictive Value (PPV) was 97.73 %, Negative Predictive Value (NPV) was 83.33 % False Positive Rate. In ERCP the Sensitivity was 77.27% Specificity was 66.67%. Positive Predictive Value (PPV) was 97.44 % Negative Predictive Value (NPV) was 28.57%. Verma D et al., [7] showed sensitivities of EUS and MRCP for the detection of choledocholithiasis to be 93% and 85%. Pamos S et al., [8] in their study found the sensitivity and specificity of MRCP and ERCP was 100 and 83.3% respectively. Additionally, MRCP was found to be better in delineating the extent of the tumor and extra biliary extension. As other sequences could simultaneously be acquired resectability and nodal status could also be assessed. ERCP images showed the level of the block however the proximal extent and involvement of adjacent structures could not be evaluated. Chen WX et al., [9] sensitivity and specificity in detection of ampullary carcinoma was 100% for ERCP and 26.83% for MRCP, while in our study it was 50% and 97.9% for both. They found a significant difference between MRCP and ERCP accuracy rate hence recommended ERCP in detecting ampullary carcinoma whereas our study is more in favor of MRCP. In our study, MRCP correctly diagnosed calculus in all 15 patients resulting in 100% sensitivity and 100% specificity. ERCP was also able to diagnose calculus in 15 patients. According to Calvo MM et al., [10] the sensitivity of MRCP in detecting cholelithiasis was 97.7% which is comparable with the results of our study. On MRCP stones were seen as filling defects in the gall bladder. MRCP failed to diagnose Stricture in 1 (2 %) cases and ERCP in 2(4%) cases. ERCP also failed to diagnose 1 tumor (2%) case. One case of stricture due to the Klatskin tumor was not diagnosed by both MRCP and ERCP. The stricture was short segment one. It is due to periductal cause. One case of periampullary growth was missed by ERCP. It was a small nonobstructive growth of terminal CBD at the level of the periampullary region. It was also

predominantly an extraluminal growth. One case of stricture was diagnosed at MRCP but preoperative findings came as normal. We false positively diagnosed the narrowing as a stricture. According to Mosler P et al., [11] ERCP is considered as a gold standard method in pancreas divisum diagnosis. According to their study sensitivity of MRCP in diagnosing the pancreas, divisum was around 73.3%.

Conclusion

MRCP has more sensitivity, specificity, and diagnostic accuracy than ERCP in diagnosing obstruction due to pancreaticobiliary disorders. MRCP can determine accurately more cases than ERCP in both cause and extent of obstruction. The anatomy of the biliary tree is well delineated by MRCP. Bile ducts proximal as well as distal to the level of obstruction are made out better by MRCP. Due to invasiveness and contrast media-induced allergic reactions, diagnostic usage of ERCP is limited. ERCP is mainly reserved for patients who required intervention in treating biliary obstruction. MRCP provides a non-invasive means to detect common bile duct stones. If MRCP is interpreted as negative for common bile duct stones, diagnostic ERCP can be avoided in most cases. MRCP replaces ERCP in diagnosing Neoplastic diseases as it provides the extent and stage of the disease an important factor in determining respectability.

***Conflict of Interest*: None**
***Source of support*: Nil**
***Ethical Permission*: Obtained**

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