

COMPARISON OF MAGNETIC RESONANCE CHOLANGIOPANCREATOGRAPHY AND ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY IN HEPATOBILIARY DISORDERS

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ABSTRACT

Objectives: Purpose of this study is to evaluate the diagnostic value of MRCP in hepatobiliary disorders and compare it with ERCP.

Study Design: Descriptive validation study

Place and duration of Study: Radiology Department Military Hospital, Rawalpindi from 15 August 2006– 15 February 2007.

Subjects and Methods: Fifty one consecutive patients included 37 males and 14 females were included.

Results: Out of 51 patients, 12 had malignant stricture, 05 had benign stricture, 06 had mass at porta hepatis, 05 had cholelithesis, 8 had choledocholithiasis, 03 had both cholelithesis & choledocholithiasis, 3 had chronic pancreatitis, 04 had mass head of pancreas, 1 had sclerosing cholangitis and 4 patients had normal studies. MRCP was sensitive and specific. Positive and negative predictive values for choledocholithiasis were 100%, 95.3%, 100% and 97.9%. For cholelithesis and benign stricture 80%, 100%, 100% and 97.9% respectively. ERCP showed 5 cases of cholelithiasis, in comparison to MRCP, which had missed one case. In detecting malignant strictures MRCP was 91.7 % sensitive and 100% specific. In cases of periampullary growths, it was difficult to cannulate the endoscope during ERCP. In these cases MRCP showed the level of obstruction non-invasively. MRCP was better in cases for chronic pancreatitis, in defining anatomy of pancreatic duct than ERCP, which has magnification factor of 1.5.

Conclusion: Our findings confirm that MRCP, a noninvasive imaging technique of greater value in the diagnosis of hepatobiliary disorders as compared to ERCP.

Keywords: Cholangiopancreatography, diagnostic Techniques, Hepatobiliary disease,.

INTRODUCTION

Obstructive jaundice needs elaborate investigation protocols. Endoscopic retrograde cholangiopancreatography (ERCP) is currently the "gold standard" for the diagnosis of pancreatic and biliary ductal pathology with a therapeutic potential¹. However, it is an operator-dependent and invasive procedure that is associated with complications² Magnetic resonance cholangiopancreatography (MRCP) is a relatively new noninvasive technique for evaluating intrahepatic and extrahepatic bile ducts and the pancreatic duct^{3,4}. It has been emphasized that its sensitivity (81-100%), specificity (94-98%), positive (86-93%) and negative (94-98%) predictive values and diagnostic accuracy (94-97%) are comparable to those of ERCP, which makes MRCP a

promising alternative to diagnostic ERCP². Moreover, MRCP is non-invasive, there are no complications, no ionizing radiation and there is no need for any contrast agent³. In certain settings MRCP may be preferable to ERCP. These include situations where ERCP might be particularly hazardous, difficult or impossible (e.g., Billroth II gastrectomy, Roux-en-Y diversions and pancreatic pseudocysts); situations where MRCP may give more information than ERCP (e.g., hilar strictures, lesions associated with complete pancreatic and/or bile duct disruption or structuring^{1,5}. MRCP can identify the larger intrahepatic ducts and the extrahepatic ducts, abnormal dilated ducts, and also reveal the level of obstruction in 80 to 100 percent of cases⁶⁻⁸. MRCP may also be useful after unsuccessful or incomplete ERCP and in imaging the CBD in patients who are to undergo laparoscopic cholecystectomy. In patients with acute pancreatitis, MRCP is useful for evaluating the bile ducts and cystic duct

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remnants for stones, for evaluating the pancreatic ducts and for documenting the presence of cysts in or around the pancreas. The diagnostic accuracy of MRCP for biliary and pancreatic disease is well documented in foreign literature; however there are few reports of its diagnostic accuracy in Pakistan.

The objective of the study was to evaluate the sensitivity and specificity of MRCP in comparison to ERCP in hepatobiliary disorders.

MATERIAL AND METHODS

The Study was conducted at Radiology department, Military Hospital Rawalpindi from 15th August, 2006 to 15th February, 2007.

Fifty one were included by Non-probability convenience sampling. All patients with hepatobiliary disorders referred for diagnostic or therapeutic ERCP and Patients of both genders were included.

Criteria for main bile duct dilatation were: a diameter greater or equal to 7mm, or greater or equal to 9mm in patients greater than 75 years or with past history of cholecystectomy.

Criteria for choledocholithiasis greater than 3mm diameter were: filling defects in CBD on MRCP / ERCP, visualization of stones on ultrasound, CT or with surgical extraction.

Criteria for small stones (choledocholithiasis less than or equal to 3mm) included: multiple small gall bladder stones on ultrasound and evacuation of fine stones seen on ERCP after sphincterotomy or during intraoperative choledochoscopy.

Criteria for benign strictures were: MRCP/ ERCP (smooth tapering of bile duct) Ultrasound, CT and/or intraoperative evidence of benign obstruction and concordant clinical evaluation.

Criteria for malignant strictures were: imaging findings on MRCP / ERCP (irregular stricture / abrupt narrowing and dilatation of proximal biliary system). On ultrasound or CT (presence of mass, abrupt narrowing and proximal dilatation of biliary system), and/or intraoperative evidence of malignant obstruction. Any concordant past medical

history or clinical evaluation, cytology and histological confirmation when available.

Data collection procedure:

After informed written consent, 51 consecutive patients were prospectively studied, in which MRCP and later ERCP was performed. All patients were imaged on a 1.5T MR unit, using a body coil. Two different image acquisition protocols (half-Fourier acquisition single-shot turbo spin-echo -HASTE- and rapid acquisition with relaxation enhancement - RARE-) for T2-weighted turbo spin echo sequences were used. Images were acquired in the coronal plane in all patients and reformatting with MIP (maximum intensity projections) sequences. The resulting T2-weighted image reproduces bile (stationary fluid) and, hence, the biliary tract in high intensity whereas surrounding tissues show a suppressed signal. Our protocol included complementary axial sequences with a QD spine coil, allowing for analysis for peribiliary and extrabiliary aspects, particularly helpful in the diagnosis of strictures. The endoscopic examination was performed by gastroenterologist blinded to the results of MRCP. All patients were sedated (neuroleptanalgesia) during endoscopy. The biliary system was opacified using an ionic contrast media containing 370 mg of iodine per ml. The images obtained with MRCP were compared with ERCP and a provisional diagnosis was made in correlation with the patient's clinical characteristics. Final diagnosis was determined in every patient based on results of MRCP, ERCP, other relevant investigations, findings at surgery and clinical course. Data was collected and recorded on a proforma (Annex A).

Data Analysis

Data was analyzed using the statistical package SPSS version 10.0. Statistical analysis for descriptive study was applied. Descriptive statistics like mean, standard deviation, frequency and percentage were calculated for data presentation. Sensitivity and specificity were calculated for MRCP taking ERCP as a gold standard. Positive and negative predictive values were also calculated.

RESULTS

Patients were studied for hepatobiliary disorders to evaluate the sensitivity and specificity of MRCP in comparison to ERCP, keeping ERCP as gold standard. Fifty one (51) consecutive patients were prospectively included and Radiologist was not blinded to the results of other imaging modalities while interpreting MRCP. Out of 51 patients 37 were male and 14 were female with a mean age of 48 years (SD 14.7) (range: 20-90 yr). Patients underwent MRCP (n =51), ERCP (n=51), ultrasound (n=51), CT (n=13), and biliary surgery (n=31). Final diagnosis was established by either surgical exploration, endoscopic sphincterotomy, by cytology or ERCP and clinical follow up.

Of the 51 MRCP studies, all visualized intrahepatic and extrahepatic ductal system. Fourty seven were of excellent quality and 4 of average quality, because of patient agitation (independent of the MRCP exam). Coronal sequences were the most optimal for detection of choledocholithiasis, including small stones. In this sequence, only intraluminal aspect of strictures could be detected. Axial sequences allowed for a better detection of intrahepatic bile duct dilatation, extraluminal aspects of biliary strictures, as well as tumors of the pancreas.

Of 5 cases of cholelithiasis MRCP diagnosed 4 cases and missed 1 case. On MRCP very distended gallbladder can have flow voids and produce artifacts. MRCP was more specific as it did not make any false positive diagnosis of cholelithiasis. MRCP correctly diagnosed 8 of the 10 cases of choledocholithiasis alone. The two cases were misdiagnosed as choledocholithiasis, which turned out to be 1 as benign and 1 as malignant stricture in final diagnosis on ERCP, clinical course and operative findings. Overall, MRCP was sensitive 100%, specific 95.3%, positive predictive value was 80% and negative predictive value was 97.9% in detecting choledocholithiasis. Out of 12 cases of malignant strictures MRCP picked 11 cases with comparable sensitivity and specificity to ERCP.

Of the 4 cases of carcinoma head of pancreas, MRCP correctly diagnosed 3 cases, level of obstruction and involvement of common bile duct by the mass. ERCP correctly diagnosed 4 cases, as it has slightly better resolution. The sensitivity was 75%, specificity was 100%. For chronic pancreatitis, MRCP showed duct dilatation and filling defects (calculi) in the pancreatic duct, in comparison to ERCP, which also showed the disease, but with magnification. Sensitivity was 100%, specificity was 97.9%, positive and negative predictive values were 75% and 100% respectively. Mass at confluence of right and left hepatic ducts (Klatskin tumors), sclerosing cholangitis & of normal studies MRCP correctly diagnosed all of them proving 100 % sensitive and 100 % specific. Final diagnoses of malignant strictures were made by cytology and histopathological confirmation in 8 out of 12 patients (2 non-specific malignant strictures, 3 cholangiocarcinomas and 3 periampullary carcinomas) and on imaging features on ERCP, ultrasound and CT.

There was good contrast between the dilated bile ducts and surrounding liver tissue and the anatomy of the bile tract was readily depicted with MRCP. ERCP also yielded high quality cholangiograms and correlated with those obtained by MR imaging.

DISCUSSION

ERCP is the gold standard for imaging of biliary tract but is associated with complications. Less invasive imaging techniques, such as MRCP, have a much lower complication rate. In this study, our results for detection of choledocholithiasis confirmed high sensitivity and specificity, especially for stones >3mm in diameter (100% and 95.3% respectively), positive and negative predictive values of 80% and 100% respectively.

Stiris et al⁹, evaluated patients with suspected CBD disease (n=50) who underwent MRCP and then ERCP. The sensitivity was 87.5% and the specificity was 94.4%, compared to our study, in which MRCP diagnosed 10 cases of choledocholithiasis, 2 cases were false positive, which were diagnosed finally on

Table1: ERCP and MRCP diagnosis

	ERCP		MRCP	
	Frequency	Percent	Frequency	Percent
Cholelithiasis	5	9.8	4	7.8
Choledocholithiasis	8	15.7	10	19.6
Cholelithiasis and choledocholithiasis	3	5.9	4	7.8
Benign stricture	5	9.8	4	7.8
Malignant stricture	12	23.5	11	21.6
Mass at the confluence of Rt and Lt hepatic duct	6	11.8	6	11.8
Mass Pancreas/ CBD	4	7.8	3	5.9
Ch Pancreatitis	3	5.9	4	7.8
Sclerosing Cholangitis	1	2.8	1	2.0
Normal	4	7.8	4	7.8
Total	51	100	51	100

Table 2: MRCP sensitivity and specificity (n=51)

	Number of cases	Sensitivity	Specificity	Positive predictive value	Negative predictive value
1. Cholelithiasis	4	80%	100%	100%	97.9%
2. Choledocholithiasis	10	100%	95.3%	80%	100%
3. Cholelithiasis and choledocholithiasis	4	80%	100%	100%	97.9%
4. Benign stricture	4	80%	100%	100%	97.9%
5. Malignant stricture	11	91.7%	100%	100%	97.5%
6. Filling defect at the confluence of right and left hepatic ducts	6	100%	100%	100%	100%
7. Mass pancreas	3	75%	100%	100%	97.9%
8. Chronic pancreatitis	4	100%	97.9%	75%	100%
9. Sclerosing cholangitis	1	100%	100%	100%	100%
10. Normal	4	100%	100%	100%	100%
Total	51				

ERCP and surgical exploration as 1 malignant and 1 benign stricture.

Jhong et al¹⁰ evaluated the ability of MRCP to detect choledocholithiasis in patients with acute pancreatitis. The sensitivity for detecting choledocholithiasis decreased with dilated bile ducts (bile duct diameter ≥ 10 mm). The combination of ERCP and IDUS improved accuracy in the diagnosis of choledocholithiasis. The results in our study showed that MRCP, on no single occasion gave false negative diagnosis of choledocholithiasis, thus being 100%

sensitive. Kaltenthaler et al¹¹ found median sensitivity and specificity for choledocholithiasis 93% and 94% respectively. These patients could avoid the unnecessary risk of complications associated with ERCP. The estimated clinical and economic impacts of diagnostic MRCP versus ERCP were very favourable.

Our results for stricture are as satisfactory as compared to those for a lithiasis. MRCP sensitivity in detecting benign stricture was again 80% and specificity was 100% showing

that MRCP can differentiate benign strictures from malignant strictures and choledocholithiasis. Sensitivity and specificity for detection of malignant strictures were also excellent. Our prospective study confirmed that MRCP, a noninvasive and well tolerated imaging technique is of value in the diagnosis of disorders of hepatobiliary tree. However one study from China by Hou et al, has concluded that ERCP was a better modality in comparison with MRCP¹². According to this study to diagnose choledocholithiasis, strictures and malignant tumors, the difference of sensitivity between ERCP and MRCP is not significant. When it comes to the specificity, ERCP was better than MRCP only in strictures. However, they found that ERCP was better than MRCP not only in total sensitivity but also in specificity of biliary tract or pancreatic diseases.

Vaishali et al¹³ determined the ability of MRCP to diagnose the level and cause of obstruction in patients with obstructive jaundice (n=30). The MRCP findings were confirmed on surgical exploration or clinical follow up. MRCP correctly identified ductal dilatation and level of obstruction in all except one case and cause of obstruction in three. It had sensitivity of 94.4%, specificity of 88.8%, positive predictive value of 89.4% and negative predictive value of 90% for detection of malignant causes. It is in agreement with our study in which 11 cases of malignant strictures were diagnosed correctly by MRCP out of 12 cases. Final diagnosis of malignant strictures were made by cytology and histopathological confirmation in 8 patients out of 12 (2 non-specific malignant strictures, 3 cholangiocarcinomas and 3 periampullary carcinomas) and on imaging features on ERCP, ultrasound and CT. MRCP showed 91.7% sensitivity, 100% specificity with positive and negative predictive value of 100% and 97.5% respectively.

Adameck et al¹⁴ showed that in MRCP, sensitivity and specificity for the detection of any abnormality (n=47) were 89% and 92%, and for the detection of malignancy (n=27) 81% and 100%, respectively. Yeh TS et al¹⁵ studied MRCP findings with reference to ERCP in

malignant perihilar biliary obstruction. As compared to our study MRCP correctly diagnosed 6 cases of perihilar biliary obstruction, at the confluence of right and left hepatic ducts with sensitivity of 100%.

Munir et al⁴, evaluated the diagnostic value of MRCP in studying the sites and causes of obstructive jaundice in comparison with other imaging modalities. The final results almost match with our results for choledocholithiasis with sensitivity of 88% and specificity of 96.8%, compared to our study with sensitivity of 100 % and specificity 95.3 %. For malignant strictures MRCP was 92.5% sensitive and 100% specific, compared to our study in which MRCP was 91.7 % sensitive and 100% specific.

Hannien et al¹⁶ combined MR imaging with MRCP and MRA for evaluation of pancreatic tumors. The sensitivity and specificity were 69% and 95 % respectively. In our study MRCP was slightly inferior in diagnosing pancreatic tumors, however it correctly evaluated the CBD involvement by pancreatic masses. It picked 3 out of 4 cases of mass pancreas with sensitivity of 75% and specificity of approximately 100%.

Clavo et al¹⁷ evaluated 78 patients with suspected biliopancreatic pathology. Both ERCP and MRCP found the pancreatic duct to be normal and nondilated in 60 patients. In nine cases, a stenotic duct of Wirsung was detected by ERCP (sensitivity 100%). Nine patients were diagnosed with pancreatic neoplasms by both techniques, with an accuracy of 100%. Four patients presented chronic pancreatitis, which were correctly diagnosed by MRCP in each case. In our study MRCP diagnosed 4 cases of chronic pancreatitis with dilated pancreatic duct and areas of signal voids in the duct which were calculi and amorphous calcium particles (seen on ERCP after sphincterotomy). Another study by Tamura R et al¹⁸ in patients with chronic pancreatitis showed that pancreatic duct diameter at ERCP was on the average 1.5 times larger, than that at MRCP.

The results of our study for choledocholithiasis clearly show that MRCP is

highly sensitive and specific for stones greater than 3mm. Sensitivity and specificity remains remarkable for benign and malignant strictures. The major drawback of MRCP with respect to ERCP is that MRCP remains a diagnostic test without therapeutic capabilities. Our results not only confirm earlier studies concerning the value of MRCP in obstructive jaundice, but also allow for its evaluation in perspective of daily practice where ultrasound and CT are often part of radiological workup.

CONCLUSION

MRCP appears to be sensitive and specific for choledocholithiasis and biliary strictures, which are the most common causes of obstructive jaundice. MRCP is easily performed in a short duration and is a noninvasive diagnostic modality. In view of our results, we conclude that MRCP be indicated in patients suspected of obstructive jaundice, especially in patients at risk for sedation or invasive ERCP techniques and in situations where main bile duct cannulation by ERCP is expected to be difficult. We recommend that MRCP needs to be advocated as a viable and non-invasive alternative with comparable sensitivity and specificity to ERCP.

REFERENCES

- Sahai AV, Devonshire D, Kay C, Feldman D, Willner I, Farber J, et al. The decision-making value of magnetic resonance cholangiopancreatography in patients seen in a referral center for suspected biliary and pancreatic disease. *Am J Gastroenterol* 2001; 96:2074-80.
- Kalra M, Sahani D, Ahmad A, Saini S. The role of magnetic resonance cholangiopancreatography in patients with suspected biliary obstruction. *Curr Gastroenterol Rep* 2002; 4:160-6.
- Czako L, Takacs T, Morvay Z, Csernay L, Lonovics J. Diagnostic role of secretin-enhanced MRCP in patients with unsuccessful ERCP. *World J Gastroenterol* 2004; 10:3034-8
- Munir K, Bari V, Yaqoob J, Khan D.B, Usman MU. The role of magnetic resonance cholangiopancreatography in obstructive jaundice. *J Pak Med Assoc* 2004; 54:128
- Lopera JE, Soto JA, Munera F. Malignant hilar and perihilar biliary obstruction: Use of MR cholangiography to define the extent of biliary ductal involvement and plan percutaneous interventions. *Radiology* 2001; 220:90-6.
- Taylor AC, Little AF, Hennessy OF, Banting SW. Prospective assessment of magnetic resonance cholangiopancreatography for noninvasive imaging of the biliary tree. *Gastrointest Endosc* 2002; 55:17-22.
- Watanabe Y, Dohke M, Ishimori T, Amoh Y, Okumura A, Oda K, et al. Pseudo-obstruction of the extrahepatic bile duct due to artifact from the arterial pulsatile compression: A diagnostic pitfall of MR-cholangiography. *Radiology* 2000;214:856-60.
- Soto JA, Alvarez O, Lopera JE. Biliary obstruction: Findings at MR cholangiography and cross-sectional MR imaging. *RadioGraphics*. 2000; 20:353-366.
- Stiris MG, TemorB, AadlandE, LundeOC. The magnetic resonance cholangiopancreatography in patients with suspected bile duct stones. *Acta Radiologica* 2000; 41: 269-272
- Jhong HO, Young D, Sang W et al. the detection of bile duct stones in suspected biliary pancreatitis. *Am J Gastroenterol* 2005 ; 100: 1051-1057
- Kaltenthaler E, Vergel YB, Chilcott J, Thomas S, Blakeborough T, Walters SJ, Bouchier H. A systematic review and economic evaluation of magnetic resonance cholangiopancreatography compared with diagnostic endoscopic retrograde cholangiopancreatography. *Health Technol Assess*. 2004;8:1-89
- Hou J, Zhan J, Yu Z, Li CQ, Zhang SN, Liang HL. A meta-analysis of clinical efficiency of two methodologies of cholangiopancreatography. *Zhonghua Nei Ke Za Zhi* 2006;45:900-3.
- Vaishali, Agawal, Updhaya et al. the magnetic resonance cholangiopancreatography in obstructive jaundice. *J Clin Gastroenterol* 2004 ; 38 : 887-890
- Adameck HE, Albert J, Weitz M et al. Prospective evaluation of magnetic resonance cholangiopancreatography in patients with suspected bile duct obstruction. 1998; *Gut* 43: 680-683
- Yeh TS, Jan YY, Tseng JH, Chiu CT, Chen TC, Hwang TL et al. Malignant perihilar biliary obstruction: Magnetic resonance cholangiopancreatographic findings. *Am J Gastroenterol* 2000; 95:432.
- Haannien EL, Amthrrer H, Hoston N et al . Prospective evaluation of pancreatic tumors: accuracy of magnetic resonance imaging with magnetic resonance cholangiopancreatography and magnetic resonance angiography. *Radiology* 2002; 224: 34-41
- Clavo MM, Bujanda L, Caldewn A et al. comparison between magnetic resonance cholangiopancreatography and endoscopic retrograde pancreatography for evaluation of the pancreatic duct. *Am J Gastroenterol* 2002; 97: 347-353
- Tamura R, Ishibashi T, Takahashi S. Chronic pancreatitis: magnetic resonance cholangiopancreatography versus endoscopic retrograde cholangiopancreatography for quantitative caliber measurement and qualitative evaluation. *Radiology* 2006; 238 : 920-928