

## **MRCP vs. ERCP**

### **CONCEPT: WHAT'S NEW MIGHT BE GOOD?**

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As with all in medicine, and especially in fields such as gastroenterology and hepatology, advances in both technology and pharmacology are ever changing. With these new advances comes the process of deciding what is truly added value with respect to both diagnosis and therapeutics, and what is just a mere blip on the radar field in the advances of medicine.

What follows is an instance of a reported new diagnostic techniques, which may have an impact on what we do both in a diagnostic and therapeutic approach to GI disease of the hepato - biliary system

#### **MRCP: Magnetic Radiologic Cholangiogram**

PMRCP is a new application of a know form of body imaging known as MRI. With this technique, a patient's Hepato-Biliary and Pancreatic system is imaged using a MRI unit, and utilizing special software, an image similar to a cholangiogram and / or a pancreatogram is obtained. This type of imaging can reproduce images very similar as those obtained from the more invasive approach with ERCP (Endoscopic Retrograde Cholanigiopancreatography) without the added risk of pancreatitis, sedation, and perforation.

The downside at present is physician interpretation of the films, and the relative new application of this software in institutions not familiar with it.

In addition, all that MRCP allows is an image, not a curative possibility, and hence the problem that faces the consultant gastroenterologist/hepatologist.

When and whom to use this new imaging technique?

In patients with highly suspected pathology in which therapeutic ERCP may have value, there is little value in obtaining an MRCP. Such patients that would benefited from ERCP would include:

- Patients with obstructive jaundice in which ultrasound or CT scan suggests biliary dilatation from either a stone or a mass, where therapeutic remedies such as stone removal or stent placement with cytology aspiration could aid in diagnosis and in improvements in symptoms.
- Biliary dyskensia in which patients with post cholecystectomy pain syndromes are being considered for sphincter of oddi manometry
- Recurrent idiopathic pancreatitis in which patients are being considered for pancreatic/common bile duct manometry
- Patients with Pseudocysts in which attempts at endoscopic drainage with

- either stents or trans-gastric cyst-gastrotomy are considered
- Post-Cholecystectomy bile leaks or surgical bile duct injuries, in which stenting of the bile duct or dilatation of strictures can occur with ERCP

Examples where MRCP may have added value are in patients with a low probability of correctable pathology as provided with therapeutic ERCP such as:

- Patients with elevated Liver Function test which have no evidence of hepato-biliary ductal dilatation on abdominal ultrasound nor CT in which the risks of ERCP are especially high. These patients would include those with compromised cardiopulmonary function, patients with known problems with conscious sedation.
- Patients with unexplained abdominal pain in whom a low probability of hepato-biliary pathology such as retained common bile duct stones, cancer, biliary dyskinesia, or idiopathic pancreatitis is suspected by both clinical presentation and previous imaging such as CT and ultrasound.
- Patients with jaundice where there is no evidence of ductal dilatation by US nor CT but CBD dilatation needs to be ruled out.

As with all new technology, the role of MRCP is still to be defined. Within Jacksonville, MRCP is available, but at present, its use is best with those of its attributes and pitfalls when ordering it.

### **Current Medical Literature on MRCP vs. ERCP**

1. The value of magnetic resonance tomography (MRT), magnetic resonance cholangiopancreatography (MRCP) and endoscopic retrograde cholangiopancreatography (ERCP) in the diagnosis of pancreatic tumors Diehl SJ , Lehmann KJ , Gaa J , Meier-Willersen HJ , Wendl K , Georgi M Fortschr Geb Rontgenstr Neuen Bildgeb Verfahr 1999 May;170(5):463-9 To prospectively evaluate the role of MRI including MR cholangiopancreatography (MRCP) compared to endoscopic retrograde cholangiopancreatography (ERCP) in the diagnosis of pancreatic cancer. MATERIAL AND METHODS: ERCP and MRI including MRCP were performed in 52 patients with suspected pancreatic cancer. MRCP was obtained using a single-shot RARE technique. The results of axial images and MRCP were compared to concurrently performed ERCP examinations. The standards of reference were the surgical and pathological findings, respectively. Image quality of MRCP was assessed using a three-step-score (1 = good, 2 = fair, 3 = nondiagnostic). RESULTS: In 88% of the cases the MRCP was of good quality. Only in 4% was MRCP non-diagnostic. The combination of MRI and MRCP showed an overall accuracy of 88%, whereas the overall accuracies of MRCP alone and ERCP were 80%, and 85%, respectively. The positive predictive values of MRI/MRCP, MRCP alone, and ERCP were 91%, 85%, and 88%, respectively. CONCLUSION: For the detection of pancreatic cancer MRI including MRCP is comparable to ERCP and can be regarded as the

method of choice in patients with suspected pancreatic cancer. ERCP is the procedure of choice in patients with contraindications to MRI and in patients in whom additional therapeutic procedures are performed.

2. Diagnostic usefulness of magnetic resonance cholangiopancreatography (MRCP) in comparison with retrograde cholangiopancreatography (ERCP) for Cholelithiasis Ahn T , Matsumoto M , Ueda S , Fukui H Nippon Rinsho 1998 Nov;56(11):2923-7 To elucidate MRCP diagnostic usefulness compared to ERCP. PATIENTS, METHODS: 29 MRCP performed patients diagnosed by ERCP were studied. RESULTS: MRCP showed 92%, 67% sensitivity and 73%, 100% specificity in choledocholithiasis (CBD) and cholecystolithiasis (GB), respectively. MRCP revealed 4.0 false positive and 1.5 false negative in CBD and GB, respectively. MRCP could detect 22 stones out of 33 in CBD and 13 out of 42 in GB. As for the maximal diameter, MRCP depicted 31% for less than 5 mm and 100% for over 6 mm in CBD. In GB, 7% for less than 5 mm, 83% for 6-10 mm and 100% for over 11 mm. CONCLUSION: Although the depiction of tiny stone is limited, MRCP is a useful diagnostic tool for cholelithiasis, especially choledocholithiasis.
3. Can MRCP replace ERCP? Takehara Y Department of Radiology, J Magn Reson Imaging 1998 May-Jun;8(3):517-34 Magnetic resonance cholangiopancreatography (MRCP) has replaced direct cholangiography and pancreatography in many instances. Its complete noninvasiveness and flexibility are less onerous for patients. For the use of screening as well as scrutiny, MRCP has played an important role in diagnosing various pathologies in this field. The usefulness of MRCP is not limited to anatomical evaluations; it can also yield physiologic and functional information. From a cost-performance basis, MRCP is undoubtedly superior to direct methods. Coupled with a cutting-edge MR system, MRCP has the potential to limit the use of invasive transpapillary and percutaneous methods merely to interventional purposes. In the near future, the emergence of interventional MR scanners will make MRCP even more competitive, and the replacement will be accelerated.
4. Comparison of endoscopic retrograde cholangiopancreatography with MR cholangiopancreatography in patients with pancreatitis. Sica GT , Braver J , Cooney MJ , Miller FH , Chai JL , Radiology 1999 Mar;210(3):605-10 To assess the usefulness of magnetic resonance (MR) cholangiopancreatography (MRCP) in the evaluation of disease in patients with acute or chronic pancreatitis. MATERIALS AND METHODS: MR imaging was performed at 1.5 T in 39 patients with chronic (n = 30) or acute (n = 9) pancreatitis. The patients underwent a pancreas MR imaging protocol that included an MRCP sequence. Comparison was made with findings at endoscopic retrograde cholangiopancreatography (ERCP), performed within 30 days. Three blinded readers used a scoring system to evaluate nine segments of the pancreatic and biliary ducts as depicted on the ERCP and MRCP images. MRCP image quality was also evaluated. RESULTS: Of 196 segments analyzed, 17 were not seen at MRCP (sensitivity, 91%). Of the segments visualized at MRCP, 14 were incorrectly characterized (accuracy, 92%). At MRCP, segments not detected or mischaracterized were either normal,

slightly dilated, or narrowed. At ERCP, 42 segments in 19 patients were not visualized. MRCP findings were considered useful in all those cases. MRCP image quality was not interpretable in two cases due to artifacts. CONCLUSION: Very good correlation between ERCP and MRCP findings was demonstrated. Both modalities failed to depict pathologic conditions depicted by the alternative method. MRCP may obviate ERCP, particularly in patients who cannot undergo ERCP or in whom ERCP has been unsuccessful.

5. Comparison of endoscopic retrograde and magnetic resonance cholangiopancreatography in the surgical diagnosis of pancreatic diseases. Yamaguchi K , Chijiwa K , Shimizu S , Yokohata K , Morisaki T , Am J Surg 1998 Mar;175(3):203-8 Magnetic resonance cholangiopancreatography (MRCP) is a newly developing noninvasive examination of the biliopancreatic trees. Roles of MRCP in the diagnosis of pancreatic diseases have not been scrutinized. METHODS: Endoscopic retrograde cholangiopancreatography (ERCP) and MRCP were reviewed in 52 Japanese patients with various pancreatic diseases and 6 patients with normal pancreas to compare their diagnostic usefulness and limitation. RESULTS: In those with normal pancreas, only the main pancreatic duct was visualized by MRCP, while both the main pancreatic and branch ducts were clearly delineated by ERCP. In 3 patients with serous cystadenoma, the tumor was not visualized by ERCP, whereas it was visible as a high-intensity mass on MRCP. Of 18 patients with a "mucin hypersecreting" tumor of the branch type, MRCP demonstrated cystically dilated branch ducts in all, while ERCP failed to visualize the dilated ducts in 6 patients. However, the details of the cystic lesions (mural nodule, communication with the main pancreatic duct) were more exactly demonstrated by ERCP than MRCP. In 5 patients with a mucin hypersecreting tumor of the main pancreatic duct type, the dilated main pancreatic duct and the presence of mural nodules were similarly demonstrated both by ERCP and MRCP. In 12 patients with pancreatic adenocarcinoma, indirect findings were similarly demonstrated both by ERCP and MRCP, i.e., stenosis (4 patients) and obstruction (8) together with dilation of the main pancreatic duct (9). In 3 patients, the center of the mass showed high intensity on MRCP, suggesting the secondary change of pancreatic carcinoma. In 8 patients with obstruction of the main pancreatic duct due to carcinoma, the distal pancreatic duct was visualized by MRCP but not by ERCP. In 9 patients who had undergone pylorus-preserving or standard pancreatoduodenectomy, follow-up MRCP was obtainable in all examined and displayed the main pancreatic duct. CONCLUSIONS: MRCP plays a complementary role in the surgical diagnosis of pancreatic disorders and is especially useful to examine the pancreatic duct after pancreatoduodenectomy.
6. Magnetic resonance cholangiopancreatography accurately predicts the presence or absence of choledocholithiasis. Hochwalk SN , Dobryansky M BA , Rofsky NM , Naik KS , Shamamian P , Coppa G , Marcus SG J Gastrointest Surg 1998 Nov-Dec;2(6):573-9 Accurate common bile duct (CBD) imaging in patients with biliary calculi is an important determinant of specific therapy. Noninvasive methods to evaluate calculi in the CBD have limited accuracy and rely mainly on ultrasonography and computed tomography. Magnetic resonance

cholangiopancreatography (MRCP) is a new noninvasive modality available to evaluate the biliary system. This study was undertaken to assess the accuracy of MRCP in predicting the presence or absence of CBD stones in patients at increased risk for choledocholithiasis. The medical records of 48 patients with a final diagnosis of biliary calculous disease undergoing MRCP between November 1995 and April 1997 were retrospectively reviewed. Three groups were identified: choledocholithiasis (n = 19), gallstone pancreatitis (n = 11), and uncomplicated cholelithiasis (n = 18). In all patients the presence or absence of CBD calculi, as determined by MRCP, was correlated with the final diagnosis obtained from endoscopic retrograde cholangiopancreatography (ERCP) (n = 19), intraoperative cholangiography (n = 6), CBD exploration (n = 13), or clinical follow-up (n = 10). Sensitivity, specificity, and accuracy of MRCP were determined. The major clinical indications for MRCP in the 48 patients were abnormal liver function tests followed by hyperamylasemia. Twenty patients were diagnosed with CBD stones and 28 were not. MRCP correctly predicted the presence of CBD stones in 19 of 20 patients and failed to detect CBD stones in one patient with gallstone pancreatitis. MRCP incorrectly predicted the presence of CBD stones in 3 of 28 patients ultimately found to have gallstones and no CBD stones. MRCP correctly predicted the absence of CBD stones in the other 25 patients including 10 patients with gallstone pancreatitis. Overall, MRCP had a sensitivity of 95%, a specificity of 89%, and an accuracy of 92%. MRCP is an accurate, noninvasive test for evaluating the CBD duct for the presence or absence of calculi in patients suspected of having CBD stones. Our data support the use of MRCP in the preoperative evaluation of these patients as findings may influence therapeutic decisions.

7. A prospective evaluation of magnetic resonance cholangiopancreatography in patients with suspected bile duct obstruction Adamek HE , Albert J , Weitz M , Breer H , Schilling D , Riemann JF. Gut 1998 Nov;43(5):680-3 The value of magnetic resonance cholangiopancreatography (MRCP) is under debate. AIMS: To assess the diagnostic accuracy of MRCP and endoscopic retrograde cholangiopancreatography (ERCP) and to determine whether MRCP may help to prevent unnecessary interventional procedures. METHODS: Eighty six patients with suspected common bile duct obstruction who presented between January and December 1996 were enrolled. Twenty six were excluded due to anatomical reasons or because MRCP or ERCP could not be performed successfully. Results of MRCP were interpreted by two radiologists and a gastroenterologist unaware of clinical diagnosis. Final diagnosis was determined by ERCP and histopathological findings or a follow up of at least 12 months. RESULTS: MRCP images of diagnostic quality were obtained in all 60 patients. Thirteen patients had a clear bile duct. 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. These results were equivalent to the respective figures of ERCP (91% and 92% for any abnormality, and 93% and 94% for malignant diseases). CONCLUSIONS: MRCP is as sensitive as ERCP in the evaluation of biliary tract diseases. As the specificity of this non-invasive technique is close to 100%, MRCP may prevent inappropriate invasive

explorations of the common bile duct and pancreatic duct.

8. Value of magnetic resonance cholangiopancreatography in demonstrating major bile duct injuries following laparoscopic cholecystectomy. Yeh TS , Jan YY , Tseng JH , Hwang TL , Jeng LB ,Chen MF Br J Surg 1999 Feb;86(2):181-4  
Conventionally, recognition of bile duct injuries after laparoscopic cholecystectomy largely relies on endoscopic retrograde cholangiopancreatography (ERCP) and percutaneous transhepatic cholangiography (PTC). However, these invasive procedures are not without risk. Preliminary experience with use of magnetic resonance cholangiopancreatography (MRCP) to identify these injuries is reported.  
METHODS: The medical records of five patients who had undergone laparoscopic cholecystectomy and had suspected major bile duct injuries were reviewed. All five patients underwent MRCP, followed by conventional cholangiography: either ERCP or PTC, or both. The findings of MRCP and conventional cholangiography were compared. RESULTS: Four patients had proven bile duct injuries. The remaining patient had gallstones dislodged into the common bile duct (CBD) during laparoscopic cholecystectomy, which presented as transient jaundice mimicking a bile duct injury. The MRCP images were of higher diagnostic value than conventional cholangiographic images in four patients with frank bile duct injury. For these patients, ERCP showed only the cut-off sign of the CBD, and PTC was needed to visualize the upper biliary system. MRCP, however, demonstrated the entire biliary system proximal and distal to the amputated or stenotic sites simultaneously. In the remaining patient with dislodged gallstones, the two techniques yielded similar diagnostic information. CONCLUSION: This preliminary study suggests that MRCP is an ideal diagnostic test whenever bile duct injury following laparoscopic cholecystectomy is suspected.
9. MR cholangiography: techniques and clinical applications. Pavone P , Laghi A , Panebianco V , Catalano C Eur Radiol 1998;8(6):901-10  
Magnetic resonance cholangiography (MRCP) is a new non-invasive imaging technique for the evaluation of bilio-pancreatic disorders. Different sequences, using both breathhold and non-breathhold techniques, have been employed in order to obtain MRCP images. The authors discuss the technical aspects, particularly focusing their attention on a non-breathhold, three-dimensional, fat-suppressed turbo-spin-echo sequence, optimized on a 0.5-T magnet with 15 mT/m gradients. Clinical applications of MRCP are evaluated, presenting data from both the literature and personal experience. The main indication for MRCP study is represented by the evaluation of common bile duct obstruction, with the aim of assessing the presence of the obstruction (accuracy 85-100 %) and, subsequently, its level (accuracy 91-100 %) and its cause. The utility of associating conventional MR images to MRCP in malignant strictures in order to characterize and stage the malignant lesions is also discussed. Finally, data are presented regarding the indications and utility of MR pancreatography in the evaluation of patients with chronic pancreatitis.
10. Comparison of magnetic resonance and endoscopic retrograde cholangiopancreatography in malignant pancreaticobiliary obstruction.

Georgopoulos SK , Schwartz LH , Jarnagin WR , Gerdes H , Breite I Arch Surg 1999 Sep;134(9):1002-7 We hypothesize that magnetic resonance cholangiopancreatography (MRCP) is comparable to endoscopic retrograde cholangiopancreatographic (ERCP) as a diagnostic tool in patients with malignant biliary obstruction. DESIGN: Eighteen patients with suspected pancreaticobiliary malignancy were evaluated by ERCP and MRCP in 8 months (March 1, 1996, to October 31, 1996). Magnetic resonance cholangiopancreatography was performed with a 1.5-T scanner using 4-mm slices. Images were obtained in a 14- to 28-second breath-hold. Images from MRCP were retrospectively evaluated by a radiologist for image quality, ductal dilation, level of obstruction, and overall diagnostic impression. Images from ERCP were retrospectively evaluated by a biliary endoscopist (L.H.S.) and served as the standard for calculating sensitivity, specificity, and positive predictive values. In addition, intraoperative findings were compared with MRCP results in all patients explored. RESULTS: Diagnostic-quality MR images were obtained in 18 patients (100%). Diagnostic-quality endoscopic images were obtained in 16 (89%) of 18 attempted biliary cannulations and 11 (78%) of 14 attempted pancreatic cannulations. Magnetic resonance CP accurately delineated the level of extrahepatic biliary ductal obstruction in 13 (87%) of 15 patients. More important, MRCP provided valuable staging information in most patients. Findings from MRCP correlated with operative findings (size and location of tumor and mesenteric vascular involvement) in 8 (80%) of 10 patients who underwent surgery, while failing in 2 patients (20%) with carcinomatosis. CONCLUSIONS: Magnetic resonance CP is a sensitive study for detecting the presence and level of biliary ductal obstruction in patients with cancer. The results are comparable to those of ERCP; however, MRCP provides additional data regarding extent of disease that is not available from ERCP alone.

11. A prospective comparison of magnetic resonance cholangiopancreatography with endoscopic retrograde cholangiopancreatography in the evaluation of patients with suspected biliary tract disease. Varghese JC , Farrell MA , Courtney G , Osborne H , Murray FE Clin Radiol 1999 Aug;54(8):513-20 To determine the diagnostic accuracy of magnetic resonance cholangiopancreatography (MRCP) compared with direct cholangiography in the detection of biliary tract disease. PATIENTS AND METHODS: MRCP was performed in 100 patients in whom direct cholangiographic correlation (ERCP, n = 98; PTC, n = 9; intraoperative cholangiography, n = 3) was available for comparison. The MRCP examinations were performed using a two-dimensional multi-slice, fast spin echo (FSE) technique and a local surface coil. The diagnoses at direct cholangiography were choledocholithiasis in 30 patients, benign and malignant strictures in 28 patients and normal bile ducts in 42 patients. The nature of the strictures (benign, n = 2; tumor, n = 18; lymphnode recurrence, n = 3; unknown histology, n = 5) was determined by one or more of the following procedures: surgery (n = 8), biopsy (n = 15), cytology (n = 6) and cross-sectional imaging/follow-up findings (n = 3). RESULTS: MRCP diagnosed choledocholithiasis with a sensitivity of 93%, specificity of 99% and accuracy of 97 %. It resulted in two false-negative and one false-positive findings when compared with direct cholangiography. MRCP accurately diagnosed the presence and level of strictures in all patients. The

overall sensitivity, specificity and accuracy of MRCP in the detection of bile duct lesions were 97%, 98% and 97%, respectively. CONCLUSION: MRCP has a high diagnostic accuracy when compared with direct cholangiography in the detection of bile duct disease.

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