

Magnetic resonance cholangiopancreatography: practical experience in 30 subjects

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ABSTRACT

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Magnetic resonance cholangiopancreatography (MRCP) is a noninvasive method of imaging the biliary and pancreatic ducts. No special patient preparation is required but the usual contraindications to MR scanning apply. The diagnostic performance of MRCP in most biliary tract diseases is similar to that of more invasive techniques of direct cholangiography such as endoscopic retrograde cholangiopancreatography (ERCP). The objectives of this study were to investigate the diagnostic efficacy of MRCP in patients with abdominal pain with lesser likelihood of having choledochal stone and to determine whether use of MRCP could eliminate the need for purely diagnostic endoscopic retrograde cholangio-pancreatography (ERCP). A total of 30 patients with suspected biliopancreatic pathology from several hospital was studied retrospectively between January 2007 and December 2008 in Jakarta. The sensitivity and specificity of MRCP was 92.59% (95% Confidence Interval, 74.25 - 98.71%) and 66.67% (95% Confidence Interval, 12.53 – 98.23%), respectively. The positive predictive value of MRCP for all biliary pathology was 96.15% (95% Confidence Interval, 78.42 – 99.79%) The negative predictive value of MRCP was 50.00% (95% Confidence Interval, 9.19 – 90.81%). MRCP seems to be effective in diagnosing patients with abdominal pain with lesser likelihood of having choledochal stone.

Keywords : Magnetic resonance cholangiopancreatography, biliary, pancreatic

INTRODUCTION

Cholangiography is often used in patients suspected of having biliary tract and pancreatic disorders to uncover the exact diagnoses of the disease. Endoscopic retrograde cholangio-pancreatography (ERCP) was considered the

golden standard method for the diagnosis of these diseases, but carries a potential risk of complications, including pancreatitis, haemorrhage, particularly from sphincterotomy sites, and duodenal perforation.⁽¹⁻³⁾ The procedure may not always be successful. ERCP is highly sensitive and specific, but is invasive

and inconvenient for the patient, requiring sedation and contrast (with minimal risk of allergic reaction), and associated with significant morbidity (5–10%) and mortality (<1%).⁽⁴⁾ At present magnetic resonance cholangiopancreatography (MRCP) begins to replace ERCP as a screening method for patients suspected of having biliary obstruction due to biliary calculus. MRCP was first described by Wallner et al. in 1991.⁽⁵⁾ The use of single-shot fast sequences in a breath-hold period provides heavily T2-weighted sequences allowing thick slices and avoiding secondary reconstructions and artifacts. This technologic development has led to its widespread use.^(6,7)

As a result, MRCP is an easy, quick, noninvasive test accessible to all patients who do not have contraindications. MRCP is also useful in patients with failed or incomplete ERCP. There is also a role for MRCP in the evaluation of patients prior to surgical procedures, to plan what kind of surgical procedure will be undertaken, and to demonstrate the alteration the bile ducts after biliary surgery. MRCP is non-invasive for studying the biliary tree and requires no ionizing radiation or iodinated contrast. It gives high-resolution projectional images of the common bile duct (CBD) with no known hazards in the absence of incompatible foreign bodies. The aim of this study was to investigate the diagnostic validity of MRCP in assessing symptomatic patients suspected of having hepatopancreaticobiliary diseases.

METHODS

Study design

This was a retrospective cohort study of a consecutive group of patients who underwent MRCP during a period of 2 years (2007 – 2008).

Patients

Patients were identified from several hospitals in Jakarta over a total period of 24-months. Collected data included clinical presentation, liver function tests, abdominal ultrasound, and MRCP findings, and procedure-related complications.

MRCP Technique

All MRCP images were obtained by using a 1.5-T superconducting magnet with a gradient strength of 50 mT/m (General Electric, Milwaukee, Wis, USA), with a body-phased array coil through the liver and pancreas. The mean time of the MRCP examination with evaluation was 15 minutes. MRCP was performed by using thick slab single shot fast spin echo (SSFSE), with selective fat saturation. The first sequence afforded a single image with a dimension of 40 mm, and exhibited the following parameters: TR/TE/FA (2800/1100/180), matrix 240 x 256, field of view of 300 mm, and acquisition time of 7 seconds. The second sequence yielded 13 contiguous 5-mm slices and presented the following parameters: TR/TE/FA (10.92/87/180), matrix 256 x 224, field of view of 280 mm, and acquisition time of 19 seconds.

Statistical analysis

The data were entered in a Microsoft Excel database. The results of MRCP were analysed against laboratory findings, ultrasound examinations and the final diagnoses for the entire study population. Sensitivity, specificity, positive and negative predictive values were individually calculated in the usual manner.

RESULTS

Thirty patients underwent MRCP and were eligible for further evaluation during the 24-month period studied, of whom 15 (50%) were

female and 15 (50%) were male with median age of 56 years (range 26–75 years). Abdominal pain was the predominant symptom at presentation (90%) with 5 subjects having associated jaundice. Pancreatitis (n=6) and cholangitis (n=22) were the other most common features.

Ultrasound

Ultrasound scan of the hepatobiliary system was the primary investigation in 30 patients, of whom 10 (33.3%) showed evidence of cholelithiasis and 2 (6.7%) of biliary sludge. Other abnormalities seen were dilated CBD, liver cirrhosis (LC), dilated gall bladder (GB), dilated extrahepatic bile duct (EHBD), dilated intrahepatic bile duct (IHBD), and choledochal cyst in fifteen patients. No abnormality was observed in 3 patients.

MRCP

Of 30 patients referred, MRCP was successfully performed in all (100.0%) patients.

Final diagnosis

The final diagnoses of the patients were: i) choledochal cysts in 3 patients (10%); ii) choledochal stone/sludge in 5 patients (16.7%); iii) gall bladder stone in 8 patients (26.7%) (Figure 1); iv) intrahepatic stone 1 patient (3.3%); v) distal obstruction of the common bile duct due to mass in 7 cases (23.3%), and follow up CT scan/MRI revealed carcinoma of the pancreas in 5 patients (16.7%) and carcinoma of the papilla in 2 patients (6.7%); vi) stricture of the common bile duct post laparoscopic cholecystectomy in 1 patient (3.3%); viii) Klatskin tumor in 1 patient (Figure 2); (3.3%); viii) post hepatico-jejunostomy operation in choledochal cyst in 1 patient (3%); and ix) no abnormality in 3 (10%) patients (Figure 3).



Figure 1. MRCP in gall bladder stone

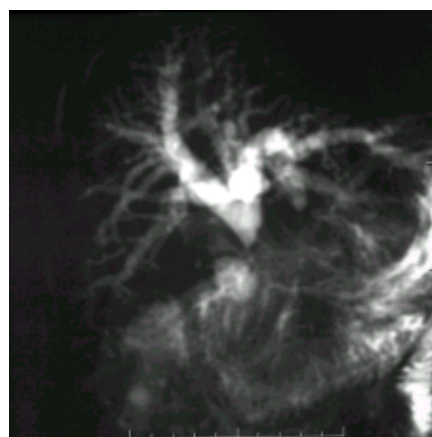


Figure 2. Klatskin tumor

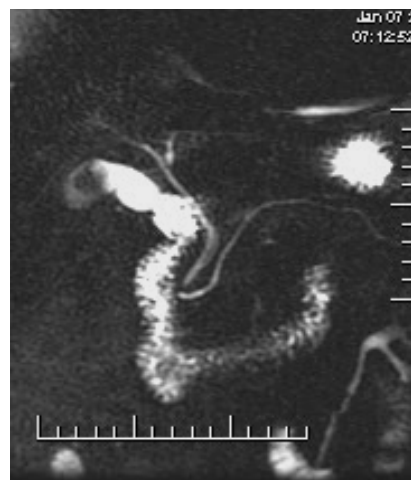


Figure 3. Normal MRCP

Table 1. Sensitivity and specificity of MRCP as evidenced against gold standard procedures

MRCP	Final diagnosis		Total
	Positive	Negative	
Positive	25	1	26
Negative	2	2	4
Total	27	3	30

Accuracy of MRCP

A total of 30 patients with complete comparative data were considered for detailed analysis. The sensitivity and specificity of MRCP was 92.59% (95% Confidence Interval, 74.25 – 98.71%) and 66.67% (95% Confidence Interval, 12.53 – 98.23%), respectively. The positive predictive value (having the disease) of MRCP for all biliary pathology was 96.15% (95% Confidence Interval, 78.42 – 99.79%) The negative predictive value of MRCP (truly disease free) was 50.00% (95% Confidence Interval, 9.19 – 90.81%) (Table 1).

There were 18 gall bladder stones, choledochal cyst, and common bile duct sludge among various positive diagnoses, based on all investigations (Table 2).

DISCUSSION

MRCP is a noninvasive method of imaging the biliary and pancreatic ducts and until now this technique continues to be improved. The basic principle underlying MRCP is that body fluids, such as bile and pancreatic secretions, have high signal intensity in heavily T2-weighted magnetic resonance (i.e. they appear white), whereas background tissues such as the surrounding liver and flowing blood generate little signal (i.e. they appear dark). As a result of this combination of imaging characteristics, MRCP provides optimal contrast between the hyperintense signal of the bile and pancreatic secretions and the hypointense signal of the

background tissue (solid organs), while blood vessels have no measurable signal. On these images the intrinsic fluids of the the biliary and pancreatic ducts make up the cholangiogram and pancreatogram.

At present, ERCP is considered the gold standard method for the diagnosis of ductal calculus, but carries a potential risk of complications, including pancreatitis, and bleeding, particularly from sphincterotomy sites and duodenal perforation.⁽⁸⁾ Most of the patients presented with the chief complaint of right upper quadrant or epigastric pain, with or without jaundice, or were jaundiced patients with or without upper abdominal pain. Abdominal ultrasound (US) and CT scan were mostly used as an initial evaluation in these patients. In these cases the roadmap of the biliary tract and the pancreatic duct is needed. The next examination will be the choice of to decide on ERCP or MRCP.⁽⁹⁾

Table 2. Different diagnoses among true positive and false negative of results of MRCP

Diagnosis	Number
True positive	
Gall bladder stone	13
Choledochal cyst	3
Carcinoma pancreas	7
Obstructed hepatojejunostomy	2
False negative	
Common bile duct sludge	1
Gall bladder stone	1
Total	27

If the complaint was due to biliary disease, i.e. choledochal stone or stricture/dilatation obstruction of the bile or pancreatic disease, it was easy to find the dilatation of the bile duct on abdominal US/CT. In these cases ERCP will be the choice because it can be followed by therapeutic endoscopy i.e. sphincterotomy and stone extraction, stent/nasobiliary tube installment etc. The choice of imaging will be ERCP when it is assumed that it will be followed by therapeutic endoscopy.⁽¹⁰⁾

If the complaints were due parenchymal liver disease, there would be no dilatation nor abnormality of the biliary tract or pancreatic duct, such that it will not be followed by therapeutic endoscopy, thus MRCP would be the choice. MRCP would be chosen when the likelihood for therapeutic intervention were less, hence unnecessary ERCP is hereby avoided. This study showed that the sensitivity and positive predictive value of MRCP for the diagnosis is extremely high, being 92.59% (95% Confidence Interval, 74.25 - 98.71%) and 96.15% (95% Confidence Interval, 78.42 - 99.79%) respectively. A prospective study in Spain found that MRCP had a sensitivity of 91% and positive predictive value of 89%, similar to our study.⁽¹¹⁾ But the specificity of 66.67% (95% Confidence Interval, 12.53 - 98.23%) was lower than that obtained in the study by Calco et al (84%). The negative predictive value in the present study was also low (50.0%; 95% Confidence Interval, 9.19 - 90.81%), compared to the Spanish study (88%).

No special patient preparation is required, but the usual contraindications to MR scanning apply.^(1,12) Patients with cardiac pacemakers, neurostimulators, or ferromagnetic aneurysm clips are excluded. The examination is usually performed after the patient has fasted for several hours to allow filling of the gallbladder and emptying of the stomach. No sedation is required, and no hospitalization is needed. In

some patients claustrophobia might be a problem.⁽¹³⁾ Oral contrast agents are not administered, no intravenous contrast agents are needed, and there is no radiation exposure.⁽¹⁰⁾ MRCP is an ideal imaging method for patients with allergies to iodide/iodine-based contrast, or those with a general history of atopy, and for preventing the occurrence of contrast nephropathy.⁽¹⁰⁾

In this study as in that from a different center,⁽¹⁰⁾ the procedures were performed with the indication as screening in patients with right upper quadrant/epigastric pain with no dilatation/equivocal dilatation of the common bile duct with/without gall bladder stone, or with normal/disturbed liver function test, with the goal to avoid unnecessary ERCP. In acute pancreatitis ERCP is avoided, because ERCP carries potential risk of complication including pancreatitis, bleeding particularly from sphincterotomy sites, and duodenal perforation.⁽¹⁴⁾

If dilatation of bile duct was found then ERCP would be the choice and subsequent sphincterotomy and extraction of choledochal stone will be retrogradely performed. MRCP is an alternative to diagnostic ERCP for the imaging of the bile tree and the pancreatic ducts. A major feature of MRCP is that is not a therapeutic procedure, while in contrast ERCP is used for both diagnosis and treatment.⁽¹⁾ MRCP is the only modality that allows imaging of these ducts in the basal state, as extrinsic contrast agents are not used,⁽¹⁰⁾ hence more accurately displays the native calibre of the duct than ERCP. Because of its noninvasive nature, it does not carry the risks and complications associated with ERCP and Percutaneous Transhepatic Cholangiography (PTC).⁽¹⁾

In MRCP there is no morbidity nor mortality like in ERCP/PTC. MRCP is particularly useful where ERCP is difficult, hazardous or impossible⁽¹²⁾ to perform, ie in patients with

anatomical/structural abnormalities, such as gastroenteric anastomosis or gastrojejunostomy. In this series MRCP was performed in a patient after hepaticojejunostomy because it was impossible to perform ERCP in this setting.

In some situations MRCP maybe preferable to ERCP, such as situations where MRCP may give more informations than ERCP (eg hilar biliary strictures, lesions associated with complete pancreatic or biliary duct cut-off). MRCP is a non invasive tool that is suitable in patients suspected of having to have pancreaticobiliary disease, where there is no likelihood or little possibility to perform therapeutic intervention, eg patients with asymptomatic cholelithiasis without clinical evidence of clinical bile duct disease, like the presence of jaundice and abnormalities of liver fuction tests.

MRCP is a non invasive imaging technique, seems to be highly accurate for the presense of obstruction,^(15,16) but is less accurate at differentiating malignant from benign causes of obstruction.⁽¹⁰⁾ It is almost as good as ERCP in the diagnoses of common bile duct stones (CBDS), although the ability of MR to detect small stones in nondilated ducts may be limited.^(10,17) MRCP may be considered as a new gold standard for the investigation of CBDS and permits reservation of ERCP to patients with a high probability of therapeutic intervention.⁽¹⁰⁾ The Eropean Association of Laparoscopic Surgeons consider MRCP to be the standard diagnostic test for patients with an intermediate probability of CBDS.⁽¹⁷⁾ The presence of intracranial metallic clips, claustrophobia, or morbid obesity might preclude MRCP.^(4,15)

CONCLUSIONS

Magnetic resonance cholangiopancreatography seems to be effective in the diagnosis of patients with abdominal pain with lesser

likelihood of having choledochal stone. It plays a fundamental role in patients with a low or intermediate risk of choledocholithiasis, contributing to the avoidance of purely diagnostic ERCP.

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