

Diagnostic accuracy of magnetic resonance cholangio-pancreatography in evaluation of obstructive jaundice

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Abstract

Objective: To determine the diagnostic accuracy of magnetic resonance cholangio-pancreatography in the evaluation of obstructive jaundice taking endoscopic retrograde cholangio-pancreatography (ERCP) as the gold standard.

Methods: The cross-sectional study was conducted at the Radiology Department of the Sindh Institute of Urology and Transplantation from August, 2009, to February, 2010. It comprised 77 patients (36 males and 41 females) with clinically obstructive jaundice referred for magnetic resonance cholangio-pancreatography evaluation. The findings were compared with the gold standard. Data was analysed using SPSS version 15.

Results: The sensitivity of magnetic resonance cholangio-pancreatography for obstructive jaundice was 97%; specificity was 75% and accuracy was 80%, while positive predictive value (PPV) and negative predictive value (NPV) were 99% and 60% respectively.

Conclusion: Magnetic resonance cholangio-pancreatography is a relatively quick, accurate and non-invasive imaging modality for the assessment of obstructive jaundice in ruling out potentially correctable underlying causes and reducing unnecessary invasive interventions.

Keywords: Obstructive jaundice, MRCP, ERCP, Radiology. (JPMA 62: 1053; 2012)

Introduction

Obstructive jaundice is a clinical terminology used for a condition associated with significant morbidity and mortality. Early and accurate diagnosis is very important in obstructive jaundice so that its outcomes should be controlled as early as possible.

Obstructive jaundice is caused by the blockage of any duct that carries bile from liver to gallbladder or from gall bladder to small intestine. It can be due to intrahepatic or extrahepatic causes.¹ Extrahepatic causes are further subdivided into intra-ductal and extra-ductal. Neoplasm, choledocholithiasis, biliary stricture, parasites and primary sclerosing cholangitis lead to intra-ductal obstruction. External compression of biliary channels by neoplasm, pancreatitis or cystic duct stones with subsequent gallbladder distention lead to extra-ductal obstruction.¹

Magnetic resonance cholangio-pancreatography (MRCP) is a new modality which should be the first choice in the study of obstructive jaundice due to its non-invasiveness and high accuracy.²⁻⁶

MRCP is relatively a new imaging technique in our country for the evaluation of obstructive jaundice and data from our part of the world is limited. The study aimed at

evaluating the role of MRCP in clinically obstructive jaundice cases. It tried to determine the diagnostic accuracy of MRCP in the detection of the cause of obstructive jaundice which helps in early and prompt treatment and limits the use of invasive endoscopic retrograde cholangio-pancreatography (ERCP) as a treatment option.

Patients and Methods

The participants of the study were included from those presenting to SIUT Karachi with clinical signs and symptoms of obstructive jaundice between August, 2009, and February, 2010, and were referred to the Radiology Department for ERCP examination. All patients who came to GI-OPD with obstructive jaundice were selected. Their laboratory data was stratified as direct bilirubin levels upto 3 mg/dl or more than 3mg/dl. The patients were then referred to the Radiology Department and, after giving informed consent, the patient underwent MRCP on 1.5 tesla state of art GE machine. The position of the patient was kept supine and 8 channel upper body array coil was used. FOV 34 cm, frequency 256 MHz, phase 128, NEX 2, bandwidth 31.25 and auto frequency of water, were used. FRFSE-XL pulse sequence was used and images were obtained in 3D mode. MRI of upper abdomen was also done whenever

needed. The patient was then sent back to the GI ward and ERCP was performed by a senior consultant (qualified fellow gastroenterologist with at least three years post-degree experience) within 48 hours of the MRCP. MRCP images were evaluated on the viewing console by senior consultant radiologist blinded to the findings of the ERCP. Data was entered and analysed using SPSS version 15. Sensitivity, specificity, accuracy, negative and positive predictive values of MRCP for the cause of obstructive jaundice was calculated by using ERCP findings.

Initially 85 patients were included in the study, but 8 of them were later excluded. Of them 8, MRCP was not performed in 3 patients due to contraindication that is having cardiac pacemaker or recent surgery with prosthesis; 2 patients had failed ERCP; one patient had refused ERCP; and 2 had left against medical advice. The final number of patients comprising the study was then 77.

Results

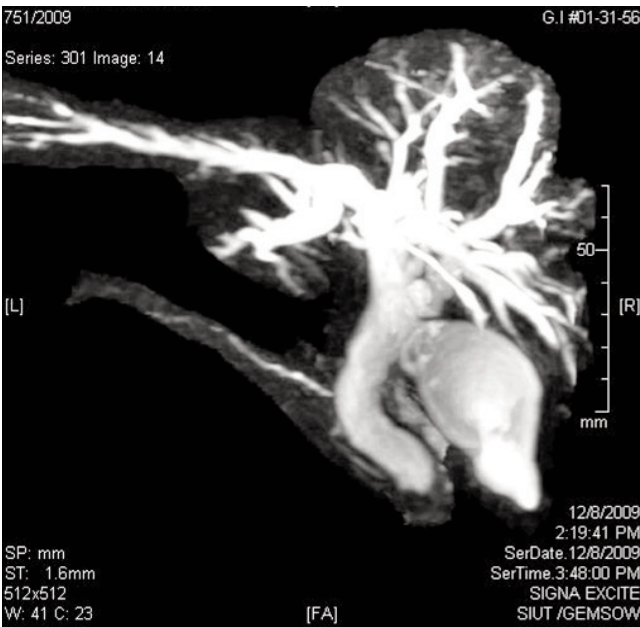
Of the 77 patients, 41 (53.2%) were females and 36 (46.3%) were males. The age ranged from 9 to 80 years, and the mean age was 47 ± 14 years. After MRCP, all patients went through ERCP within 48 hours

In our study, the most common cause of obstructive jaundice was choledocholithiasis mostly with dilatation of common bile duct (CBD), seen in 64 (82%) patients. Of the 64, one had calculus in the right hepatic duct, one had in the middle part of CBD (associated with stricture) and 43 had calculi in the distal CBD, while 19 patients had multiple calculi in middle, distal CBD and in the gall bladder. Of the 7 (9%) patients with benign stenosis, 1 showed an iatrogenic stenosis due to ERCP; three were diagnosed with malignant stenosis; and 3 were normal (Figure-1A and 1B).

MRCP correctly diagnosed the cause of obstruction in 74 of the 77 patients, so its accuracy in detection of cause was

96.1%. There were 71 true positive cases. However, there was 1 false positive case. There were 2 false negative and 3 true negative cases as well. The sensitivity of MRCP was found to be 97% and specificity was 75%. Positive predictive value of MRCP was 98.6% while the negative predictive value was found to be 60%.

The study also tried to stratify the data in early (direct bilirubin level upto 3 mg/dL) and advanced jaundice. In early jaundice the accuracy, sensitivity and specificity were 80%, 85% and 66% respectively. However, in case of advance jaundice, accuracy, sensitivity and specificity were 98%, 98% and 100% respectively (Table).



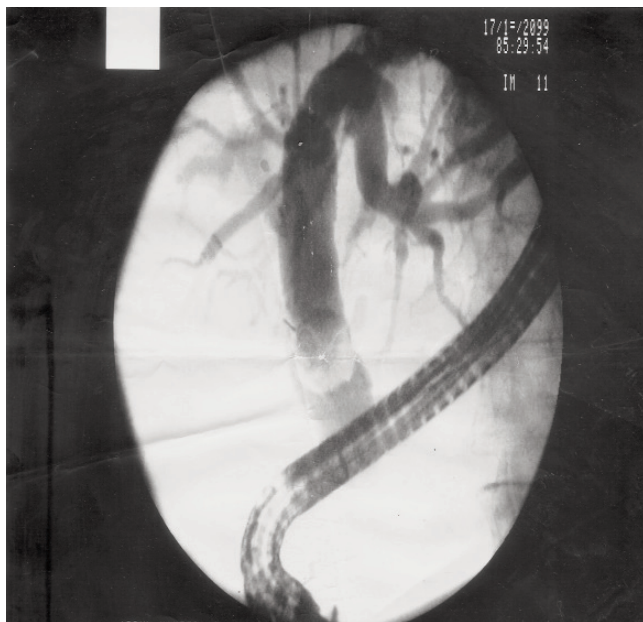
CBD: Common bile duct.

Figure-1A: Dilated CBD with calculus in distal CBD (3D image).

Table: Results in early and advanced jaundice.

MRCP Results	ERCP Results		Total
	Positive (+ve)	Negative (-ve)	
In Early Obstructive Juandice (< 3.0 gm)			
Positive (+ve)	6	1	7
Negative (-ve)	1	2	3
	7	3	10
Of 10 patients with early obstructive jaundice MRCP showed a diagnostic accuracy of 80%, with a sensitivity of 85% and a specificity of 66%, PPV 85% NPV 66%.			
In Advanced Obstructive Juandice (>3.0 gm)			
Positive (+ve)	65	0	65
Negative (-ve)	1	1	2
	66	1	67
Of 67 patients with early obstructive jaundice, MRCP showed a diagnostic accuracy of 98% with a sensitivity of 98% and a specificity of 100%, PPV 100% NPV 50%.			

MRCP: Magnetic resonance cholangio-pancreatography. ERCP: Endoscopic retrograde cholangio-pancreatography. PPV: Positive predictive value. NPV: Negative predictive value.



ERCP: Endoscopic retrograde cholangio-pancreatography.

Figure-1B: ERCP showing large filling defect (calculus) in dilated CBD.

Discussion

Generally, patients coming to hospital with obstructive jaundice are initially assessed by ultrasound. The sensitivity of ultrasound is limited and varies amongst operators. The sensitivity of abdominal ultrasound in choledocholithiasis varies between 20 to 80%.⁷ However, accuracy of endoscopic ultrasound is more than 90%.^{5,8} The other non-invasive procedure used in initial assessment is computed tomography (CT) which again has variable sensitivity, limited availability and involves radiation exposure. CT scanning may be insensitive for detecting stones in the CBD especially in case of pure cholesterol stones. The sensitivity of CT for choledocholithiasis is variable ranging from 23 to 85%.⁷ The insufficiency of ultrasound and CT lead to repeated examinations which causes delay in treatment. On the other hand are direct cholangiographic techniques like percutaneous transhepatic cholangio graphy (PTC) and ERCP. The success rate of PTC is very high when intra-hepatic ducts are dilated.⁹⁻¹¹ Its reported accuracy in defining the level of obstruction is more than 90%.^{9,12} Complications include sepsis, bile leak, intra-peritoneal haemorrhage, haemobilia, hepatic and perihepatic abscess, pneumothorax, skin infection and granuloma at the catheter entry site. Complication rates can be high, may be upto 10% of the cases.¹³ ERCP is the gold standard for evaluation of the bilio-pancreatic region.^{2,14} ERCP can help detect intra-hepatic and extra-hepatic biliary duct dilatation, stones, and the site of bile duct stricture with the highest accuracy (approximately 90-100%).^{3,15} ERCP is associated with significant complications, including pancreatitis, bleeding, perforation, infection, and

cardiopulmonary depression from conscious sedation.¹⁶ ERCP is associated with significant complication rates of 1-7%, such as haemorrhage, sepsis, pancreatitis and bile leak, as well as a recognised mortality of up to 1%.¹⁷ Few studies have reported potential decrease in ERCP practice after the introduction of MRCP.¹⁸ Thus PTC and ERCP give high accuracy rates but are invasive and have high complication rates. So, the need of an accurate and patient friendly technique is evident. MRCP has almost filled this gap. In literature, the sensitivity of MRCP is above 90% for detection of the cause in obstructive jaundice.^{2-4,6,7,19} There are multiple techniques of MRCP, providing high-resolution images of biliary tree. These include breath-hold technique, fast spin imaging, HASTE (Half Fourier Acquisition Single Shot Turbo Spin Echo), respiratory gated 3-D etc. We used respiratory gated, FRFSE-XL (Fast Recovery Fast Spin Echo-Accelerated) pulse sequence in our study which provides quality images with less acquisition time. Our results were comparable with most of the studies done previously.

In one study¹⁷ MRCP had sensitivity, specificity, positive and NPV of 87%, 80%, 83.3% and 84.2% respectively. Another study²⁰ showed accuracy of 89.65%, sensitivity of 94.4% and specificity of 81.8%. In our study MRCP showed a diagnostic accuracy of 96.1%, with a sensitivity of 97% and a specificity of 75%. The sensitivity was higher than the studies cited above, but the specificity in our study was slightly lower because a small stone of less than 3mm was missed by the MRCP in our study. The overall accuracy of MRCP in our study was higher than the one done in India.²⁰

Previously most studies used heavily T2 weighted SSFSE (Single Spin Fast Spin Echo) sequence. The 3D FRFSE-XL is a 3D FSE (Fast Spin Echo) pulse sequence which operate with the respiratory triggering, ASSET (Arraycoil Spatial Sensitivity Encoding Technique) and facilitates fast recovery.

Being a T2 weighted sequence, this is valuable for aiding characterisation of extra-ductal (contained within the liver and pancreas) solid and cystic masses and provides supplementary information regarding fluid within the ducts and any other pathologically associated collection.

The fast recovery feature is designed to enhance the intensity of fluids that have long T2 relaxation times, while using a shortened TR time.

The purpose of respiratory triggered sequence is to acquire images of biliary tree with improved spatial resolution, while maintaining an acceptable level of the contrast resolution.

The ASSET is a parallel imaging technique, which has an inherently lower signal-to-noise ratio value, improved imaging times and highly prominent contrast demonstrated between the fluid-filled ducts and the background tissues.²¹

In our study the commonest cause of obstructive jaundice was choledocholithiasis mostly with dilatation of CBD. This finding was seen in 64 (82%) of our patients. Only

two false negatives and one false positive case were recorded in our study. In 10 patients the cause of obstruction was stricture; 7 benign and 3 malignant.

Cholangiographic appearance of biliary stricture is similar regardless of the technique. The presence of a mass, stricture with long length (3.0cm vs 1.2cm), irregular margin and asymmetric dilatation of the bile ducts helped in making a diagnosis of the malignant stricture. regardless of modality, a lengthy segment of extra-hepatic bile duct stricture with irregular margin and asymmetric narrowing suggests cholangiocarcinoma and a short segment with regular margin and symmetric narrowing suggests benign cause. this differentiation may be similarly difficult with both tests.^{23,24}

In our study we also tried to stratify our data in early (direct bilirubin level upto 3.0 mg/dl) and advanced jaundice (direct bilirubin level > 3.0 mg/dl). MRCP showed high diagnostic accuracy, specificity and sensitivity not only in advanced cases but also in early jaundice.

Many recent studies demonstrated high rates of spontaneous relief from obstruction within 48 hours after the onset of acute biliary obstruction,²⁴ so justification of invasive technique like ERCP in early jaundice is questionable. In addition, evolutionary pressure from competing technologies (endoscopic ultrasonography, EUS; and magnetic resonance cholangiopancreatography, MRCP) has greatly challenged the need for diagnostic ERCP²⁴ In our study, we proved the accuracy of MRCP in early jaundice, so we recommend the use of MRCP instead of ERCP in early jaundice to save patients from unwanted possible complications of ERCP .

We also recommend MRCP technique we used that is the respiratory-triggered 3-D fat sat, FRFSE-XL pulse sequence in the evaluation of obstructive jaundice due to its high accuracy in early and advanced stages.

Our study has a few limitations as it was a single-centre and had a small sample size. All the MRCP examinations were interpreted by experienced radiologists who were blinded to ERCP findings. However, inter-observer variability of MRCP findings was not assessed.

Conclusion

The 3-D respiratory gated technique of MRCP is considered an accurate method of diagnostic imaging in the evaluation of obstructive jaundice both in early and advanced stages. The accuracy of MRCP and its non-invasiveness have considerably restricted the diagnostic role of ERCP.

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