

MAGNETIC RESONANCE CHOLANGIOGRAPHY VERSUS ENDOSCOPIC RETROGRADE CHOLANGIOGRAPHY IN THE DIAGNOSIS OF OBSTRUCTIVE JAUNDICE

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Over the past decade, magnetic resonance cholangiography (MRC) has evolved not only as a feasible means of noninvasively evaluating the pancreaticobiliary tract but also as a technique with documented diagnostic accuracy in the evaluation of obstructive jaundice. We evaluated the success rate of both endoscopic retrograde cholangiography (ERC) and MRC in diagnosing the level and cause of obstruction in 40 patients with obstructive jaundice. The success rate of ERC was 94.7%, but with complications related to therapeutic procedures in two patients. MRC, however, achieved a 95% success rate in diagnosing the level and nature of obstruction. This study demonstrates that MRC has a definite role as a noninvasive diagnostic tool for the evaluation of obstructive jaundice.

Key Words: Obstructive jaundice - Endoscopic retrograde cholangiography - Magnetic resonance cholangiography - Choledocholithiasis - Bile duct stricture - Pancreatic cancer - Cholangiocarcinoma

INTRODUCTION

ERC is currently the "gold standard" for the diagnosis of obstructive jaundice. Nevertheless, there are well-recognized drawbacks including potentially life-threatening complications, need for skilled endoscopists, and costs⁽¹⁾. Recently, MRC has been increasingly used in the diagnosis of various biliary and pancreatic disorders including obstructive jaundice⁽²⁻⁷⁾. In addition to its noninvasive nature, MRC may be preferable to ERC in certain settings e.g., Billroth II gastrectomy, Roux-en-Y diversions, pancreatic pseudocyst, sclerosing cholangitis, prior serious ERC complications⁽⁸⁾. Recent literature reviews showed that MRC compares favorably to ERC in terms of sensitivity (81-100%), specificity (94-100%), and overall accuracy (94-97%), depending on the pathology in question (e.g., choledocholithiasis versus malignancy)^(1, 7, 9-11). We conducted this prospective study to compare the diagnostic accuracy of ERC and MRC in determining the level, and the nature of obstruction in a cohort of patients with obstructive jaundice.

PATIENTS AND METHODS

Forty consecutive patients presented with obstructive jaundice during the period from September 1999 to November 2002 were included in this study. Obstructive jaundice was diagnosed by the presence of dilatation of any portion of the biliary tree on abdominal ultrasound examination. There were 26 males and 14 females. The mean age was 46 years, with a range of 8 to 79 years.

All patients were subjected to thorough history, physical examination, and routine laboratory investigations as well as coagulation profile including prothrombin time and concentration and activated partial thromboplastin time. Correction of coagulation defect was done when necessary.

Subsequently, all patients underwent abdominal ultrasonography as the initial imaging study. In addition to documenting bile duct dilatation, scanning also included the liver, gallbladder, and pancreas. The presence of hilar masses or ascites was documented.

Patients were then randomly divided into two groups. Group A (n=20) was subjected to ERC while group B (n=20) underwent MRC. The final diagnosis was documented by operative findings or by other diagnostic modalities e.g. computerized tomographic (CT) scanning. All diagnostic and therapeutic interventions were performed after obtaining informed consent from all patients.

ERC. Patients in group A underwent ERC. Stone extraction and stent placement were performed as necessary. The endoscopic procedures were performed after an overnight fast, under short-acting general IV anesthesia with propofol (Diprivan). Endoscopy was performed with a side viewing video-endoscope (Olympus TJF 200). On reaching the duodenum, hyoscine N-butylbromide (Buscopan) 20mg was administered intravenously to induce relaxation of the duodenum. The ampulla was cannulated and contrast (urograffin 60% diluted 1:1) was injected under fluoroscopic guidance taking care not to inject air.

MRC. Patients in group B were subjected to MRCP using 1.5 Telsa Gyroscan (Philips ACS) and a body coil with the commercially available software. MRC was performed with a T2-weighted inversion recovery sequence with a layer of 3 mm, and 1.5 mm overlapping tomography in the coronal orientation and respiratory triggering. T2-weighted and fat suppressed MR cholangiograms were processed with a maximum intensity projection algorithm to create three-dimensional images of the biliary tree and pancreatic duct.

RESULTS

US results

Dilated CBD (> 6mm) and dilated intrahepatic biliary

radicals were encountered in 30 (75%) and 34 (85%) patients, respectively. The CBD could not be visualized in six patients (15%). US demonstrated CBD stones in 14 patients (35%). US was able to identify the level of biliary obstruction in 34 patients (85%). Biliary obstruction was suggested at the lower end of CBD in 30 patients (75%), at hilar level in four patients (10%), and could not be assessed in six patients (15%). The nature of obstructing lesion was diagnosed as calcular in 14 patients (35%), pancreatic mass in ten (25%), hilar in four patients (10%), and could not be identified in the remaining six patients (30%), with a total prediction rate of 70%.

ERC results

ERC was completed successfully in nineteen out of 20 patients (95%). The only single failure was due to inability to cannulate a papilla situated in a diverticulum. Of the nineteen patients with successful ERC study, eleven patients (55%) had choledocholithiasis (Fig. 1) and eight patients (45%) had extrahepatic malignant obstruction (Fig. 2). Details of ERC findings are shown in (Table 1). These nineteen patients underwent endoscopic sphincterotomy with or without duct clearance and stenting in the same endoscopic session. One patients with a stone in the diagnostic ERC was found to have no stones. This may be due to an air bubble inadvertently injected during ERC or the patient may have passed the stone spontaneously. Therefore, these data demonstrate that the overall success rate of ERC in predicting the level and nature of obstruction is 94.7%. Two complications related to therapeutic interventions were encountered in this group. One patient suffered bleeding following sphincterotomy that was successfully controlled by direct diathermy coagulation. Another patient developed mild pancreatitis that subsided on conservative medical treatment.

Table (1):. ERC findings

<i>Findings</i>	<i>Number (%)</i>	<i>Final Diagnosis</i>
Successful cannulation of CBD	19 (95%)	-
Choledocholithiasis	11 (55%)	10 (50%) no stones could be found in one
Pancreatic head cancer	4 (20%)	4 (20%)
Cholangiocarcinoma	3 (15%)	3 (15%)
Ampullary cancer	1 (5%)	1 (5%)
Diagnostic accuracy	18/19 (94.7%)	-

MRC results.

MRC could visualize the entire course of the extrahepatic bile ducts in all patients (Table 2). MRC

images were of excellent quality in nine patients and of average quality in one patient due to the patient agitation. Coronal sequences were the most optimal for detection of

choledocholithiasis including small stones. In this sequences, only intraluminal aspect of strictures could be detected. Axial sequences allowed for better detection of intrahepatic bile duct dilatation, extraluminal aspect of biliary strictures, as well as tumors of pancreas. The normal gallbladder is constantly visible during MRCP due to the high signal intensity of its contents.

Gallbladder stones were shown as distinct foci of low signal intensity in the dependent part of the gallbladder. Dilated intrahepatic biliary radicals could be followed into the outer third of the hepatic parenchyma in sixteen patients (80%). The main pancreatic duct in the body and tail of pancreas was identified in fourteen patients (70%), and the accessory duct was visualized in six patients (30%). The mean diameter of the CBD at the level of its maximal

dilatation was 18 mm with a range of 12 to 23 mm. Six patients (30%) were diagnosed as having CBD stones. Stones as small as 3 mm in size were visualized even in the presence of mild dilatation of CBD, since there is usually sufficient bile surrounding the stone to create a contrast between the low signal intensity of the stones and the high signal intensity of the bile (Fig. 3). One of these patients proved to have ampullary cancer on subsequent ERC to remove the stones. The other fourteen patients (70%) of this group had malignant obstruction. Seven patients had pancreatic head cancer (Fig. 4). One patient had ampullary cancer, two patients had cholangiocarcinoma and four patients had hilar obstruction. Therefore, these data demonstrate that the overall success rate of MRC in predicting the level and nature of obstruction is 95%.

Table (2): MRC findings

<i>Findings</i>	<i>Number (%)</i>	<i>Final Diagnosis</i>
Successful study	20 (100%)	-
Choledocholithiasis	6 (30%)	5 (25%) one proved to be ampullary cancer
Pancreatic head cancer	7 (35%)	7 (35%)
Cholangiocarcinoma	2 (10%)	2 (10%)
Ampullary cancer	1 (5%)	2 (10%) one was diagnosed as a stone
Hilar obstruction	4 (20%)	4 (20%)
Diagnostic accuracy	19/20 (95%)	-

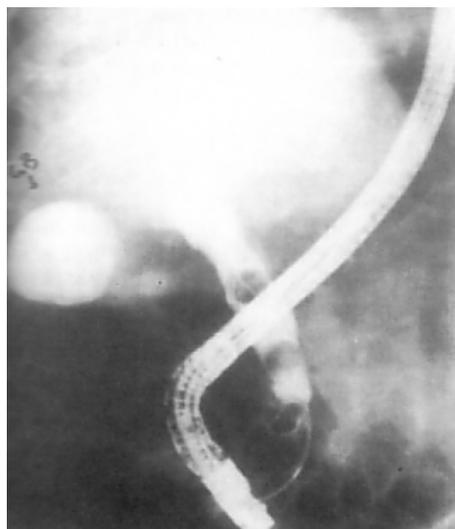


Fig. (1):. Endoscopic picture demonstrating dilated CBD with at least two rounded medium size stones.

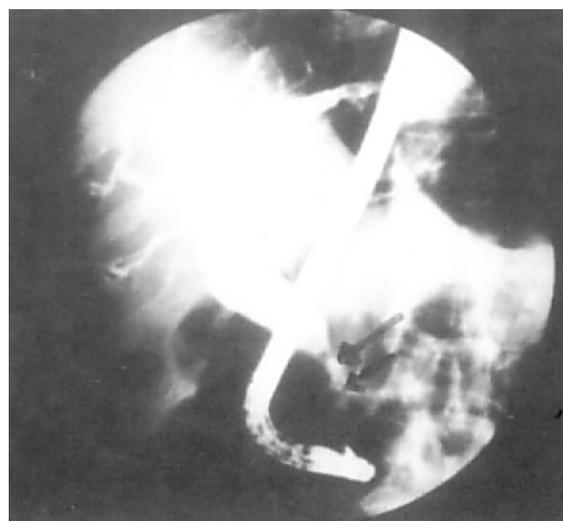


Fig. (2):. ERC showing malignant obstruction of the CBD (arrows) with proximal dilatation.



Fig. (3): MRCP image showing dilated intra- and extrahepatic biliary tree, distended gallbladder (arrow head), and multiple stones in the CBD (arrows).



Fig. (4): MRCP image showing dilated intra- and extrahepatic biliary tree, distended gallbladder (arrow head), and malignant obstruction of the CBD (arrow) suggesting pancreatic head cancer.

DISCUSSION

The ability of magnetic resonance imaging to depict a dilated biliary tract was first demonstrated in 1986. Five years later, magnetic resonance cholangiopancreatography (MRCP) was described for the first time, representing a completely noninvasive application allowing visualization of the biliary and pancreatic ducts - similar to the images produced by endoscopic retrograde cholangiopancreatography (ERCP), but without the need for routine sedation, intravenous contrast, and radiation exposure (4, 6). Moreover, MRCP is less investigator dependent than ERCP, ultrasonography, or percutaneous transhepatic cholangiography (12).

MRCP imaging relies on the fact that the biliary and pancreatic duct fluids are relatively static. By applying a heavily T2-weighted sequence the fluids will appear white. CBD stones will appear as well-defined signal void structures in the ducts (13). MRCP was found to be highly sensitive (90-100%) for visualization of the normal CBD. In addition, dilatation of the bile duct is always visible during MRCP (10).

There is currently no consensus regarding the precise role of MRCP in the clinical assessment of patients with suspected bile duct obstruction. Although the presence and site of biliary obstruction can be identified by percutaneous ultrasonography, evaluating the cause of such obstruction may be more difficult and requires direct cholangiopancreatography. ERCP often only demonstrates the duct below the site of obstruction; visualization of an obstructed part of the biliary tree is often not possible. In

addition, opacification of undrained bile ducts places the patient at risk of cholangitis. Other serious complications of ERCP include pancreatitis, perforations, and bleeding. Cholangitis and pancreatitis occur respectively in 1.0% and 5.4% of patients undergoing biliary sphincterotomy, even in expert centers (4). Recent studies of MRCP have claimed high accuracy in depicting various biliary and pancreatic disease entities (14). MRCP can detect the presence of biliary obstruction and the level of the obstruction with a sensitivity of about 90% and a specificity reaching almost 100%. In addition, it routinely identifies the dilated biliary tree upstream of an obstruction, allowing synchronous strictures to be identified (15).

Several studies have compared MRCP and ERCP (4, 9, 13, 16, 17). Stiris and his associates prospectively compared MRCP versus ERCP in 50 consecutive patients with suspected CBD stones. Both examinations were performed within 12 h of each other to minimize the incidence of spontaneous passage of small stones between the two examinations. In their hands, MRCP had a sensitivity of 87.5% and a specificity of 94.4% and therefore, they concluded that MRCP is good enough to replace ERCP as a diagnostic method in patients with suspected CBD disease (13). Taylor and his colleagues studied 129 patients found that the sensitivity and specificity values for MRCP compared to direct cholangiography were 97.9% and 89%, respectively (9).

Other studies have compared MRCP to ERCP or intraoperative cholangiography in patients with suspected CBD stones before laparoscopic cholecystectomy. Liu et al prospectively evaluated the efficacy of MRCP, in

comparison with standard cholangiography, in identification of CBD stones in 99 patients before laparoscopic cholecystectomy. They reported MRCP sensitivity, specificity and accuracy of 85%, 90%, and 89% respectively (18). Demartines et al studied 70 patients with suspected CBD stones and reported an MRCP overall sensitivity and specificity of 100% and 95.6%, respectively. The authors state that MRCP-based diagnosis can reduce the number of invasive preoperative diagnostic procedures and their associated risks and overall health care costs (12).

Adamek and his colleagues in a prospective controlled study evaluated pancreatic cancer detection with MRCP and ERCP in 124 patients with a strong clinical suspicion of pancreatic cancer. They found that the sensitivity of MRCP with respect to diagnosing pancreatic cancer was 84% and its specificity is 97%, while the corresponding values for ERCP were 70% and 94% respectively. Thus, in comparison to ERCP, MRCP was slightly more sensitive and at least as specific in diagnosing pancreatic carcinoma (5). Several investigators proposed that MRI along with MRCP and magnetic resonance angiography will replace, in a single examination, all other imaging techniques currently used to stage this tumor and assess resectability (6, 19, 20).

ERCP in hilar strictures carries a substantial risk of cholangitis when the opacified ducts cannot be drained adequately in the same session. Yeh and his coworkers studied the efficacy of MRCP and ERCP in the evaluation of malignant perihilar biliary obstruction in 40 patients. ERCP examination was unsuccessful in two patients. Both MRCP and ERCP were very effective in detecting the presence of biliary obstruction. MRCP was superior to ERCP in interpreting the cause and depicting the anatomical extent of the perihilar obstructive jaundice (14). Zidi et al compared MRCP with ERCP in 20 patients referred for endoscopic palliation of a hilar obstruction. MRCP was of diagnostic quality in all but two patients (90%), and correctly classified the Bismuth type in 14 of 18 cases (78%). The authors concluded that MRCP should be used to plan interventions in the treatment of malignant hilar obstructions (21).

Another clinical situation where MRCP was found to have superior diagnostic value to that of ERCP is in the evaluation of iatrogenic bile duct injuries. MRCP can accurately diagnose postoperative biliary strictures and excision injuries and can characterize and anatomically classify these injuries for planning reparative surgery. MRCP has additional advantages: It is rapid, safe, and noninvasive and therefore can be performed emergently, facilitating the workup in this group of patients whose treatment requires quick decision making. It can visualize above and below the level of obstruction, a capability provided by neither ERCP nor PTC that is essential for surgical planning (22, 23).

Despite this diagnostic superiority, the primary criticism of MRCP has been the fact that no therapeutic option can be offered at the same time that the diagnostic information is obtained. Therefore, some potential clinical applications of MRCP have been suggested, including patients who have illdefined diagnosis of obstructive jaundice, patients who require evaluation of the entire biliary tree before definite management, patients who have undergone unsuccessful ERCP, and patients who have undergone partial gastrectomy or biliary-enteric bypass (14).

In conclusion, this study demonstrates that MRC, in addition to its noninvasive nature, produce a contrast quality images of the biliary tree that are comparable to ERC images but lacking its therapeutic potential. Therefore, MRC has a definite and expanding role as a diagnostic tool for the evaluation of obstructive jaundice.

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