Magnetic Resonance Cholangiopancreatography in Post Laparoscopic Cholecystectomy Patients

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Abstract

Objectives: To determine the usefulness and diagnostic performance of Magnetic Resonance Cholangiopancreatography (MRCP) combined with Conventional Abdominal Magnetic Resonance Examination (CAMRE) in post laparoscopic cholecystectomy patients, and to compare the results with Endoscopic Retrograde Cholangiopancreatography (ERCP).

Methods: The study group consisted of 113 patients (30 men and 83 women) who had undergone laparoscopic cholecystectomy. Magnetic Resonance Imaging (MRI) examinations were performed with 1.5 T super conducting unit (magnetom vision plus, siemens). Conventional magnetic resonance imaging of the upper abdomen followed by magnetic resonance cholangiopancreatography using a half fourrier single shot turbo spin-echo sequences were done for all patients. Findings were correlated with endoscopic retrograde cholangiopancreatography, ultrasound and clinical follow up.

Results:

Magnetic resonance cholangiopancreatography was adequate in all patients. Fifty three (47%) patients had normal MRCP findings. In 60 (53%) patients, MRCP showed biliary dilatation. Bile duct stones were diagnosed in 19 (17%) of them and strictures of the bile ducts and papilla in 26 (23%) of the patients. The nature of the strictures was: benign in 16 patients and malignant in 10 patients. In 15 (13%) patients no evidence of obstructive bile duct disease was demonstrated. The overall sensitivity, specificity and accuracy of MRCP in the detection of bile duct lesions in post laparoscopic cholecystectomized patients were: 93%, 99% and 97%, respectively.

Conclusions: We conclude that MRCP can offer a non-invasive highly effective diagnostic modality for the evaluation of patients with post cholecystectomy biliary disorders.

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Keywords

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Introduction

Laparoscopic Cholecystectomy, a minimally invasive technique has replaced open cholecystectomy as the treatment of choice for symptomatic cholelithiasis. It offers a cosmetic advantage and rapid recovery.[1,2] The post cholecystectomy syndromes have not changed, but more definitive diagnosis have been described and better treatments devised with the introduction of endoscopic techniques. ERCP has been and continues to be an important resource in the diagnosis and treatment of post cholecystectomy disorders, particularly in dealing with stones left in the Common Bile Duct (CBD).[3] However, ERCP has associated rare severe complications such as pancreatitis, perforation and even death,[4] which are much less acceptable in this time of rapid development in the diagnosis and treatment methods, especially when ERCP is performed for rather soft indications, such as post cholecystectomy pain. For this reason, a simple, safe and non-invasive diagnostic alternative would be desirable. Herein lies the attraction of MRCP as an alternative to diagnostic ERCP for imaging the biliary tract.

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MRCP was discovered in 1991[5], and since then, the technique has progressively improved. It utilizes heavily T2 weighted imaging sequences that result in selective high signal intensity of static or slow moving fluid, such as bile and pancreatic secretions contained within the biliary and pancreatic ducts. MRCP is not associated with morbidity or mortality risks. A major feature of MRCP is that it is not a therapeutic procedure whereas ERCP is used for diagnosis and treatment. The impact of this is that if ERCP is necessary after MRCP as therapeutic intervention, MRCP would have been avoided, but if no need for therapeutic intervention is found, MRCP could avoid the small but definite potential morbidity and mortality risks associated with ERCP. The purpose of our study was to assess the diagnostic performance of MRCP compared to ERCP in post cholecystectomy patients suspected of having biliary duct disease.

Methods

Patient Population: Between June 2001 and August 2004, 113 consecutive patients who had previous laparoscopic cholecystectomy were referred for MRCP. There were 30 male patients and 83 female patients (age range, 21-83 years. Mean age, 53 years). The main reasons for MRCP imaging were stones or biliary duct dilatation detected by ultrasound (41%), right upper quadrant pain with or without dyspepsia (69%), clinical jaundice (12%), and abnormal liver function tests (25%).In all patients, laparoscopic cholecystectomy was performed without intraoperative cholangiogram.

Imaging Protocols: MRCP& CAMRE Imaging: all patients were imaged on a 1.5 T vision plus magnetom system (Siemens medical system, Germany), using body phased array receive coil. All patients fasted overnight (6-8 hours) before examination in order to promote gastric emptying and to avoid superimposition of duodenal contents on the normal bile duct. All patients underwent Conventional upper Abdominal Magnetic Resonance Examination (CAMRE) immediately before MRCP. For CAMRE imaging, TIGE, T2 FSE and T2 spin-echo with fat saturation sequences in axial plane were obtained. For MRCP imaging half fourier single shot turbo spin-echo (HASTE) images with fat suppression were obtained in the coronal and coronal oblique planes followed by three dimensional reconstruction by using MIP algorithm.

ERCP: ERCP was performed by a senior gastroenterologist or by trainee fellows in gastroenterology under direct supervision of a senior endoscopist. All patients were sedated during endoscopy. The biliary system was opacified using non-ionic water soluble contrast material injected directly into the CBD under fluoroscopy control. Radiographs were obtained for all patients. At the end of each examination, the ERCP findings were recorded and later on, both MRCP and ERCP reports were compared and analyzed.

Imaging Analysis: All MRI examinations were reviewed by two independent radiologists. The printed source, images and reformatted MIP images were provided. The radiologists were aware of the clinical data, but not of the ERCP results or the final diagnosis. In cases where the two radiologists disagreed, a final decision was made by consensus. The images were evaluated for:

1- Presence of bile duct dilatation: Extra hepatic bile duct dilatation was diagnosed if the maximum duct diameter was > 9 mm. Intra hepatic bile duct dilatation was diagnosed if the intra hepatic duct dilatation was > 3mm.

2- Bile duct stones: A stone was diagnosed when a low signal, well defined rounded or faceted structure surrounded by high signal bile was present (figure 1). The meniscus sign, which is usually seen with lower bile duct stones at ERCP, was also used for the diagnosis of CBD stones. The size of biliary stones was measured on CAMRE images.

3- Bile duct stricture: stricture was defined as a focal area of ductal narrowing or signal loss with proximal dilatation (figure 2). Malignant stricture was diagnosed if one or more of the following findings were seen on the combined MRCP and CAMRE imaging: irregular stricture with shouldered margins or rat-tail appearance, abrupt obstruction of the bile duct with proximal dilatation (figure 3), double duct sign or identification of a

A soft tissue mass or tumor associated with stricture. Stricture with smooth tapered margin, and not associated with soft tissue mass, was considered as a benign stricture.

Figure 1:

Figure 2:

Figure 3:

Results

MRCP and CAMRE Imaging: Adequate MRCP and CAMRE images were obtained in all 113 patients. MRCP was normal in 53(47%) patients. Biliary tract dilatation was diagnosed in 60(53%) patients, of them, 19(17%) patients had bile duct stones, and 26 (23%) patients had bile duct and papillary strictures. In 15(13%) patients, no evident cause for bile duct dilatation was detected. Biliary dilatation was seen in both intra and extra hepatic bile ducts in 18 patients. In 8 patients, both the bile duct and pancreatic ducts were dilated. In the remaining patients, the CBD only was dilated.

Stones ranged in size from 3 mm to 23 mm in diameter. Multiple biliary stones were present in 6 patients. In 2 patients, multiple intra and extra hepatic bile duct stones were detected. Stones were situated in the lower bile duct in the majority of patients. MRCP missed tiny CBD stones (<3mm) in two patients (two false-negative results). In both of them, the stones were also overlooked on ERCP and only detected at sphincterotomy and CBD evacuation. A false-positive diagnosis was also made for one patient in whom the MRCP showed multiple low signal areas in the CBD interpreted as stones. However, at ERCP performed later, no CBD stones were found. Of 26 strictures diagnosed on MRCP, 10 were malignant (Cholangiocarcinoma, n=6; Ampullary carcinoma, n=2; Pancreatic head tumor, n=2), and 16 were benign (papillary stenosis, n=7; chronic pancreatitis, n=4; iatrogenic stricture, n=3; Cholangitis, n=2). Biliary dilatation proximal to the stricture was clearly seen in all 26 patients. Extra ductal disease was detected in 8 patients (liver abscess, n= 4; chronic liver disease, n= 2; hydatid cyst of the liver, n= 1; subphrenic abscess, n= 1).

ERCP: Selective ERCP was attempted in 62 patients (in all patients who had abnormal bile ducts on MRCP and in patients with persisting pain in spite of normal MRCP). ERCP was successfully performed in 58(94%) patients and failed in 4(6%) patients: (situs inversus, n=1; huge periampullary diverticulum, n=1; unknown cause,n=2). Bile duct dilatation was diagnosed in 56(97%) of the patients who had successful ERCP. 18 patients had intra and extra hepatic biliary dilatation, 8 patients had bile ducts and

Table 1: Results of MRCP and CAMRE imaging in 113 patients.

Findings	No. of patients	Percentage
Biliary tract dilatation:	60	63%
Bile duct stones	19	17%
Malignant strictures	10	9%
Benign strictures	16	14%
Idiopathic dilatation	15	13%
Normal MRCP	53	47%
Normal MRCP (with extra biliary abnormality at CAMRE imaging)	8	7%
Liver metastasis	4	
Chronic liver disease	2	
Hydatid cyst of the liver	1	
Subphrenic abscess	1	

Table 2: Results of ERCP in 58 patients.

Findings	No. of patients	Percentage
Biliary tract dilatation	56	97%
Bile duct stones	20	34%
Malignant strictures	10	17%
Benign strictures	19	33%
Idiopathic dilatation	9	19%
Normal diagnostic ERCP (but sandy stones evacuated at sphincterotomy)	2	3%

pancreatic duct dilatation. Bile duct stones were diagnosed in 20(34%) patients; multiple stones were present in 9 patients, and 2 patients had multiple stones in both intra and extra hepatic bile ducts.

Strictures were identified in 29(50%) patients, of them 10 were malignant (Cholangiocarcinoma, n=6; Ampullary carcinoma, n=2; Pancreatic head tumor, n=2), and 19 were benign strictures (Papillary stenosis, n=9; Chronic pancreatitis, n=4; iatrogenic strictures, n=3; Cholangitis, n=3).

MRCP versus ERCP: ERCP confirmed biliary dilatation in 56 patients; all of them were correctly diagnosed of having bile duct dilatation on MRCP indicating a 100% accuracy of MRCP in detecting biliary tract dilatation. MRCP diagnosed 19 patients with bile duct stones including one patient who had CBD stone and failed the ERCP due to situs inversus. This gave sensitivity, specificity and accuracy of 90%, 98% and 95%, respectively for MRCP in diagnosing Choledocholithiasis. MRCP correctly identified the presence and site of stricture in (26) of (29) patients with bile duct strictures diagnosed on ERCP resulting in a sensitivity of 90%, specificity of100% and accuracy of 96%, respectively in the MRCP diagnosis of biliary strictures.

Discussion

Laparoscopic Cholecystectomy has replaced open cholecystectomy in the management of symptomatic gall bladder stones with minimal invasiveness, rapid recovery and better cosmetic results. However, post cholecystectomy complications and problems such as retained or residual bile duct stones, pancreatitis and biliary injury are still frequently seen. The introduction of ERCP revolutionized the management of problems encountered in patients before or after laparoscopic cholecystectomy and replaced open surgery and percutaneous techniques in the diagnosis and treatment of many of these problems.

Before laparoscopic cholecystectomy selective ERCP was recommended only for patients with signs and symptoms suggestive of bile duct or pancreatic duct pathology in order to avoid unnecessary ERCP with its potential hazards.[6] This is supported by the fact that only 5% of patients considered low risk for bile duct stones actually have stones in intraoperative cholangiogram.[7] In a German study, 90% of ERCPs performed before laparoscopic cholecystectomy were negative for biliary calculi, and there was a 2% incidence of procedure-related pancreatitis.[8]

After laparoscopic cholecystectomy, there is a strong debate against the universal use of ERCP as the first procedure in patients with suspected biliary tract disorder in spite of its therapeutic capability based on the reality that ERCP is an invasive and costy procedure that is associated with morbidity and mortality rates of 5-11% and 0.2-1%, respectively,[9,10] and reported failure rate of 3-30%.[11,12] Furthermore, a large number of ERCPs with normal findings may be performed. B. Topal et al [13] demonstrated that ERCP, which was performed on patients with suspected stones, could not demonstrate any stones in 51% of them. Therefore, an initial MRCP as a safe and accurate procedure that can select patients with bile duct disorders for further management would be a useful first line option. In our study, 47% of patients with suspected biliary tract disorder after laparoscopic cholecystectomy had normal MRCP examination and therefore we saved them the potential hazards of unnecessary ERCP. MRCP is a well established safe technique that is able to produce highly accurate cholangiographic images similar to that of direct cholangiography.

We performed our MRCP examinations using 2D; multi slice turbo spin-echo (HASTE) technique followed by three dimensional reconstructions using MIP algorithm. Our results indicated a high accuracy rate in the diagnosis of post laparoscopic cholecystectomy biliary disorders using this technique.

In our study, MRCP had a sensitivity, specificity and accuracy of 90%, 98% and 95%, respectively in the diagnosis of bile duct stones. J.C. Varghese et al [14] using a 2D, multi slice, FSE technique and a shoulder surface coil

had a sensitivity, specificity, and accuracy of 93%, 99% and 97%, respectively in diagnosing cholelithiasis, Pavone et al [15] using a 3D, FSE, non breath hold technique had a sensitivity, specificity and accuracy of 92%, 100% and 97%, respectively.

In our study, we missed stones in 2 patients (two false negative results). In both patients, normal caliber ducts with smooth tapered distal end was diagnosed on MRCP. Due to persisting pain ERCP was performed which also showed normal bile ducts without filling defects, sandy stones less than 3 mm were evacuated upon endoscopic sphincterotomy in both of them. These findings demonstrated decreased diagnostic reliability of MRCP for stones less than 3mm in diameter and also indicated that small size stones may not be diagnosed by ERCP unless sphincterotomy and duct exploration are used. There was also one false-positive diagnosis that occurred in a patient in whom multiple well-defined signal voids were seen in the CBD. At ERCP, the bile duct was seen to be dilated but no evidence of stones was demonstrated. Retrospectively, these signal voids were interpreted as air bubbles. Our study showed that MRCP was 100% accurate in diagnosing bile duct dilatation. Miyazaki et al [16] using a HASTE sequence correctly diagnosed biliary dilatation in all patients included in his study. Y Rondeau et al [17] and other studies in the literature reported a sensitivity, specificity and accuracy of 100% for MRCP in detecting biliary tract dilatation. In addition, the MRCP can show the full extent of the dilated biliary ducts clearly and give more accurate measurements of the bile duct diameter than ERCP since the injection of contrast material during ERCP may cause biliary distension. Non-specific biliary dilatation was diagnosed in 15 patients (no evidence of obstructive disease was demonstrated). In all of them, the CBD only was dilated, and in none of them the CBD diameter was more than 13mm. It is possible that CBD dilatation was due to previous cholecystectomy.

In our study, the reported sensitivity, specificity and accuracy of MRCP in the detection of presence and level of stricture were 90%, 100% and 96%, respectively. These results were also comparable to other sensitivity rates reported in the literature.[18,19,20]

The combined use of MRCP and CAMRE imaging helped us in differentiating the causes of bile duct dilatation; it also allowed us to detect extra ductal disease in 8 patients. These would have been missed if ERCP has been done as the first procedure. Fulcher et al [21] reported a sensitivity of 100% and a specificity of 98% in the differentiation of causes of bile duct obstruction using combined MRCP and CAMRE techniques, Kim et al [22] found that sensitivity, specificity and accuracy can be increased by 17%-20% when conventional T1 and T2 images are combined with MRCP.

Conclusion

Our results conclude that MRCP is a reliable imaging technique that can confirm or exclude biliary tract pathology in post laparoscopic cholecystectomized patients and suggest that a preliminary diagnostic MRCP should be performed whenever possible before ERCP to select patients with biliary tract disorders for further management based on its findings.

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