Impact of magnetic resonance cholangiography on endoscopic therapy before and after laparoscopic cholecystectomy

Qais Gutub Contractor, Anupam Kumar Karkaria, Tasneem Qais Contractor, Mohammed Kheir Dublan

Departments of Internal Medicine, Radiology and Surgery, King Fahad Specialist Hospital, P O Box 2290, Buraidah, Qassim, Kingdom of Saudi Arabia

Objective: To assess the impact of magnetic resonance cholangiography (MRC) on endoscopic therapy before and after laparoscopic cholecystectomy (LC). Methods: Ninety-six patients were referred for endoscopic retrograde cholangiography (ERC) before or after LC because of abnormal liver function tests, raised serum amylase, or abnormal ultrasound scan (USS) of the biliary system. All patients underwent MRC before ERC. Results: Common bile duct (CBD) stones were detected in 48 patients on ERC, 40 on MRC, and 23 on USS. The CBD was dilated on ERC (>8 mm) in 59 patients, on MRC (>7 mm) in 51, and on USS (>7 mm) in 42. Abnormal CBD (dilated ± stone) was detected in 69 patients on ERC, 57 on MRC, and 44 on USS. Intrahepatic ducts were dilated on ERC in 26 patients, on MRC in 24, and on USS in 18. The study was abnormal on ERC in 81 patients, on MRC in 63, and on USS in 51. Endoscopic therapy was attempted in 80 patients. Presence of CBD stone (p=0.03), dilated CBD (p=0.01), abnormal CBD (p=0.0007), and abnormal study (p=0.0004) on MRC were significantly related to endoscopic therapy. In 6 cases LC was deferred because MRC revealed CBD calculi which could not be cleared endoscopically. ERC could be avoided in 14/19 patients who did not benefit from it. Conclusion: MRC findings are significantly related to endoscopic therapy in patients referred for ERC before and after LC, and they influence therapeutic decisions in some of them. [Indian J Gastroenterol 2004;23:8-11]

Keywords: Endoscopic retrograde cholangiography

Since the initial report in 1986, magnetic resonance cholangiography (MRC) has emerged as an accurate non-invasive modality for imaging the biliary tree.1-5 The value of T2-weighted fast spin-echo MR imaging of the biliary tree was initially recognized in a retrospective review of 10 patients with stones in the common bile duct (CBD).2 The use of MRC in the preoperative evaluation of patients suspected to have CBD stones and its influence on therapeutic decisions was subsequently observed in clinical studies.3,4,6 Interobserver agreement for MRC was also excellent for the diagnosis of choledocholithiasis. Its sensitivity and specificity have been shown to be better than those of ultrasound scan (USS) and comparable to endoscopic retrograde cholangiopancreatography (ERCP) and transhepatic cholangiography.6,7

ERCP, an invasive procedure, is considered the gold standard for biliary tract imaging and is frequently performed for suspected CBD disease in patients undergoing laparoscopic cholecystectomy (LC). The limitations and complications of ERCP are well known.8,9 Its advantage over MRC is its potential for therapeutic intervention. However, MRC may prevent negative ERC and thereby decrease morbidity and mortality. Absence of a stone in a patient with suspected choledocholithiasis was the single most potent risk factor for post-ERCP pancreatitis in one study.10 It seems that ERC is most dangerous for people who need it the least.11

We have shown that presence of abnormal CBD sonography is the best predictor of choledocholithiasis before LC.12 However, one-third of such patients had a negative ERC. Most patients who present with biliary pain and jaundice after LC need endoscopic therapy.13 Even in this group of patients MRC could have led to the avoidance of ERC in some of them.

We prospectively assessed the value of MRC in patients referred for ERC both before or after LC.

Methods

Over a 3-year period (1999 to 2002), 96 patients referred for ERC, before or after LC, were studied prospectively. Patients had been referred with altered liver function tests (LFT), raised serum amylase, or abnormal USS, i.e., CBD stone, dilated CBD, or subhepatic fluid collection. The ethics committee of the hospital approved the protocol. All patients underwent MRC prior to ERC.

MRC was performed without sedation within 24 hours before ERC using a 1.5 Tesla unit (GE Medical Systems-Europe, Paris, France) with a standard body coil. For orientation, a T2-weighted fast spin-echo (FSE) of the liver was obtained (TR 4000, TE 120, slice 7.0, 2.0, axial plane). MRC examinations were carried out with a 2-dimensional FSE sequence (2D, FSE, TR 7000, ETL 24, TE 180, slice 3.0 overlapping coronal plane). MRC films
were interpreted by the radiologist prior to ERC.

ERC was performed under conscious sedation. If CBD calculi were detected, endoscopic papillotomy (EPT) was done and stones were extracted. For biliary leaks after cholecystectomy, EPT was performed with or without percutaneous drainage of intra-abdominal fluid collection. Patients with biliary sludge pancreatitis and biliary dyskinesia (Milwaukee Classification, Biliary II) underwent only EPT. If CBD stones could not be cleared before LC, open cholecystectomy was recommended. Surgery was also advised for complete bile duct transection by a clip.

Statistical analysis was performed using SPSS for MS Windows Release 6.0 (SPSS, Chicago, IL, USA). Sensitivity and specificity were calculated for presence of CBD stone, dilated CBD (>7 mm on USS and MRC, and >8 mm on ERC), abnormal CBD (dilated CBD and/or stone), intrahepatic duct dilatation (right/left hepatic duct >2 mm on USS and MRC, and >4 mm on ERC), and abnormal study (any of the above abnormalities or subhepatic fluid collection). Need for endoscopic therapy was correlated with abnormal LFT, raised serum amylase (>500 U/L), biliary pancreatitis, and abnormalities detected on USS and MRC. Categorical data were analyzed using χ² test with Yates' correction; p values less than 0.05 were considered significant.

Results

The 96 patients (69 females) had a median age of 41 years (range 7-90). Seventy (73%) patients were referred before LC and 26 (27%) after. Biliary pain was reported by 91 (94.8%) cases, jaundice by 66 (69%), and 6 were febrile. LFT were abnormal (at least 3 of 4, viz. bilirubin, ALT, AST, alkaline phosphatase, were elevated) in 83 (87%) and serum amylase was >500 U/L in 25 (26%) cases. Leukocytosis was recorded in 25 (26%) cases. Biliary pancreatitis was diagnosed in 19 (20%) patients.

USS was not done in one patient. The status of intrahepatic ducts was not commented upon on USS in 9 cases. MRC was technically not satisfactory in 3 patients. Size of CBD could not be assessed in one patient on MRC. One patient refused MRC due to fear of entering the tunnel and was excluded from the study.

Abnormalities of the biliary tract on USS, MRC, and ERC along with their sensitivity and specificity rates are shown in Table 1.

In 3 cases prior to LC, MRC showed large CBD calculi (>15 mm). Due to lack of availability of mechanical and extracorporeal shock-wave lithotripsy, endoscopic therapy was unsuccessful. In 3 other cases, CBD stones (<15 mm) detected on MRC could not be cleared endoscopically as CBD could not be cannulated. LC was deferred in all these cases. In one patient with biliary pancreatitis and failed CBD cannulation, a normal MRC preceded another attempt at ERC. A proper cholangiogram could not be obtained in an uncooperative patient after extracting a stone impacted at the ampulla.

Endoscopic therapy was attempted in 80 (83%) patients and was beneficial in 74 (92.5%). CBD stones could be cleared in 44 of 50 cases. Biliary leak after LC responded to EPT in 4 cases. Biliary stenting was done for a benign CBD stricture in an elderly patient. EPT was performed in 4 patients with biliary sludge pancreatitis. Twenty patients with evidence of biliary dyskinesia had EPT, 13 before LC and 7 after LC. EPT was performed in one patient with pancreatitis who had a low cystic duct attachment and retrograde filling of contrast from CBD into the pancreatic duct.

Twenty-two patients did not benefit from ERC. In retrospect, ERC could have been avoided in 14 of these—13 with endoscopic evidence of recent passage of CBD stone and one with clip on the CBD diagnosed on MRC. CBD stones could not be cleared in 6 patients; LC was deferred in these as MRC had revealed CBD stones. MRC could not diagnose a clip on the CBD in 1 patient as the study was technically poor. A patient with right hepatic duct stricture did not have endoscopic therapy and this abnormality was not diagnosed on MRC.

Correlation of abnormalities detected on USS and MRC, abnormal LFT and raised serum amylase to endoscopic therapy is shown in Table 2.

Discussion

The sensitivity and specificity of various biliary tract abnormalities detected on MRC in this study was superior to that of those detected at USS but inferior to those at ERC. This could be due to the fact that we used gradient echo method with body receiver coils. Recently, spin echo refocused methods based on RARE (rapid acquisition with relaxation enhancement) and its variants combined with specialized surface receiver coils have improved image quality with faster image acquisition.

Twenty percent of the CBD stones detected on
Table 2: Relation of abnormalities of biliary tract on USS and MRC with endoscopic therapy

<table>
<thead>
<tr>
<th>Abnormality</th>
<th>Endoscopic therapy</th>
<th>P*</th>
</tr>
</thead>
<tbody>
<tr>
<td>USS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBD stone</td>
<td>20/23</td>
<td>ns</td>
</tr>
<tr>
<td>Dilated CBD</td>
<td>37/42</td>
<td>ns</td>
</tr>
<tr>
<td>Abnormal CBD</td>
<td>39/44</td>
<td>ns</td>
</tr>
<tr>
<td>Abnormal study</td>
<td>45/51</td>
<td>ns</td>
</tr>
<tr>
<td>MRC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CBD stone</td>
<td>37/40</td>
<td>0.03</td>
</tr>
<tr>
<td>Dilated CBD</td>
<td>47/51</td>
<td>0.01</td>
</tr>
<tr>
<td>Abnormal CBD</td>
<td>53/57</td>
<td>0.0007</td>
</tr>
<tr>
<td>Abnormal study</td>
<td>59/63</td>
<td>0.0004</td>
</tr>
<tr>
<td>Abnormal LFT</td>
<td>68/63</td>
<td>ns</td>
</tr>
<tr>
<td>Serum amylase &gt;500 U/L</td>
<td>16/25</td>
<td>0.005</td>
</tr>
</tbody>
</table>

*p values indicate significance of abnormalities for the need for endoscopic therapy

ERC were missed on MRC whereas USS missed nearly 50% of them. None of these CBD stones was >15 mm and all of them were extracted endoscopically. MRC has a distinct advantage over USS is that it is non operator dependent. USS, however, is a useful screening investigation in patients with cholelithiasis. It can diagnose the exact level and cause of obstruction in about 60% and fewer than 50% of cases, respectively.17 It is difficult to see the lower end of the bile duct due to overlying gas in the duodenum and bowel. Endoscopic sonography is more sensitive in detecting stones in this area with an accuracy of greater than 90%.18 It, however, lacks therapeutic capability. Recently, over-the-wire US catheter probe as an adjunct to ERC has been shown to be accurate in detecting CBD stones even in patients with normal-diameter bile ducts.19 This technique preserves access to the cannulated bile duct, differentiates stones from air bubbles, and prevents unnecessary sphincterotomy.

The accuracy of MRC in detecting CBD stones has been frequently reported to be greater than 90%. However, in the present study, 8 CBD stones were missed on MRC and these were picked up on ERC. Sensitivity is lower for stones less than 6 mm in diameter.5 Of 8 CBD stones missed on MRC in our study were less than 6 mm. It has been reported that MRC underestimates the number of CBD stones present.7 This belief was not confirmed in the present study.

Virtual CT cholangiography provides an endoluminal view of the biliary tree. However, it is less sensitive than fiberoptic cholangiography in detecting CBD stones smaller than 5 mm.20 Hence it is unlikely to replace ERC.

Need for endoscopic therapy was related better to abnormalities detected at MRC than at USS. In fact, ERC could have been avoided in 14 of 19 patients. In 13 of these there was evidence of recent passage of CBD stone, and in one patient MRC had shown a clip on the CBD. Spontaneous migration of small calculi from the CBD into the duodenum, with gallbladder in situ, can occur in about 20% within one month of detection.21 In the present study, 12 of 13 patients with evidence of spontaneous migration of CBD stone had gallbladder in situ. An important biochemical feature of 8 of these cases was improving LFT. In a preoperative screening for CBD stones in at-risk patients, it was reported that MRC would have reduced the need for ERC by three-quarters.22 A lower negative ERC rate in our study could be related to differences in referrals pattern.

In patients with biliary pancreatitis, MRC is a useful imaging modality. ERC can be avoided if MRC does not reveal CBD stones. In the present study, ERC could have been avoided in 6 of 19 patients with biliary pancreatitis as there was no evidence of CBD calculi on MRC. Moreover, MR imaging of the pancreas grades the severity of pancreatitis thereby cautioning the endoscopist to be less aggressive during ERC if the pancreatitis is severe.

MRC helped in diagnosis of iatrogenic bile duct injury after LC in 4 of 6 cases. Fluid collection in the gallbladder fossa, subhepatic collection or free peritoneal fluid was seen in 3 of 4 patients with cystic duct leak. The CBD was clipped in 2 cases though the clip was not seen in one of them. Recently, MRC has been shown to accurately diagnose postoperative biliary strictures and excision injuries and classify these injuries for planning reparative surgery.23 The entire biliary system proximal and distal to the amputated or stenotic site can be simultaneously demonstrated on MRC.

Being noninvasive, MRC is better tolerated than ERC. However, in a questionnaire survey, only 59% of patients clearly preferred MRC over ERC.24 The preference was more marked for patients undergoing diagnostic ERC. One of our patients refused MRC due to claustrophobia, whereas none refused ERC. Patient satisfaction can be improved with selective premedication, earplugs and the use of the new, quieter fenestrated MRI scanners.

MRC may also be useful in pregnant women. If MRC excludes a CBD stone ERC can be avoided.25 None of our patients was pregnant.

MRCP was reported to have a unique and valuable role in the investigation and management of patients in whom ERCP failed or was inadequate.26 Cannulation of CBD at ERC was unsuccessful in 4 of our patients and MRC helped in management decisions in them. Three of these found CBD stones and hence LC was deferred. In one patient with biliary pancreatitis, MRC revealed a normal CBD, hence a second ERC was not attempted.

In conclusion, endoscopic therapy is significantly related to abnormalities detected on MRC performed prior to ERC in patients referred before or after LC. It helps in making therapeutic decisions in some of them. It is particularly useful in avoiding ERC in those with

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pancreatitis, complete transection of CBD, improving LFT, and failed ERCP.

References