Accuracy of magnetic resonance cholangiopancreatography for diagnosing stones in the common bile duct in patients with abnormal intraoperative cholangiograms

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Abstract

BACKGROUND: Magnetic resonance cholangiopancreatography (MRCP) is a noninvasive method for diagnosing cholelithiasis. It is said to be as accurate as the gold standard endoscopic retrograde cholangiopancreatography (ERCP) for detecting common bile duct (CBD) stones. A study was needed to look at the accuracy of MRCP compared with intraoperative cholangiography (IOC) for detecting stones in the CBD. The aim of this study was to evaluate the diagnostic accuracy of MRCP in patients with cholelithiasis diagnosed with IOC.

METHODS: This was a retrospective study looking at patients who underwent IOC. Results were compared with respective preoperative MRCP results if available.

RESULTS: Four hundred twenty patients who underwent IOC were reviewed and met criteria for the study. Seventy patients had preoperative MRCP. Accuracy of MRCP when compared with IOC was 70%.

CONCLUSIONS: MRCP has a high rate of false normal results compared with IOC and is not as accurate as more invasive techniques. There is no need for preoperative MRCP in patients with suspected choledocholithiasis caused by stones.

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stones leading to biliary obstruction often present with abnormal liver function test results and symptoms such as pain in the right upper quadrant, fever, nausea, and vomiting. An ultrasonogram is usually the first-line imaging study in patients with a biliary disorder because it is quick and inexpensive, but it is very operator dependent, and although it can detect a dilated CBD, its accuracy for detecting CBD stones is poor.\(^5,^6^\) The sensitivity of ultrasonography in diagnosing CBD stones varies from 20% to 80% depending on the operator. \(^6^\) ERCP is currently described as the gold standard for the diagnosis of CBD stones in many texts, because it allows for direct visualization of the duct and can be diagnostic as well as therapeutic. It is 1 of several invasive direct cholangiography techniques. IOC is another invasive technique that allows for direct visualization of the duct using contrast medium and can also be considered a gold standard procedure. IOC has a decreased incidence of postprocedure pancreatitis and cholangitis compared with ERCP: 5.4 and 1%, respectively. \(^5^,^6^\) Often the surgeon will obtain an intraoperative cholangiogram when CBD stones are suspected or as part of a routine cholecystectomy. Because cholecodolithiasis is very prevalent in the United States and there are many studies stating that MRCP is as accurate as ERCP in detecting CBD stones, \(^1^\) we felt a study was needed to look at the accuracy of MRCP when compared with IOC in detecting CBD stones in the local population. This study was conducted at Leigh Memorial Hospital in Norfolk, VA.

Methods

This was a retrospective study looking at 420 patients between the ages of 18 and 89 years during a 2-year period (June 2008 to June 2010) who underwent IOC at Leigh Memorial Hospital. Results in all patients who underwent IOC at the time of laparoscopic cholecystectomy were compared with the respective preoperative MRCP results if available. The inclusion criterion was any patient who had IOC at the time of cholecystectomy at Leigh Memorial Hospital between June 2008 and June 2010. Exclusion criteria were patients who did not undergo IOC or patients who had CBD dilatation from causes other than stones, such as malignancy or stricture. ERCP results, if available, were not included in the statistical analysis for comparison. MRCP was a T1-weighted image and secretin was not used. Besides the MRCP and IOC results, total bilirubin, CBD size in millimeters, stone size if available, the patient’s weight in kilograms, and body mass index (BMI) were also collected in this study for comparison. Outcome measures included the sensitivity and specificity of MRCP compared with IOC, as well as the positive and negative predictive value and overall accuracy of MRCP when compared with IOC. Secondary measures included correlation of liver function test results and CBD size to predict the possibility of an abnormal result on IOC, and the correlation of a BMI higher than 40 to an increased rate of false normal results on MRCP. Patients for this study were found from a billing database query using Current Procedural Terminology codes for laparoscopic cholecystectomy with IOC. All the patients’ electronic medical records were reviewed to determine which patients had preoperative MRCP, which was ordered in most cases because of an elevated total bilirubin level.

Statistical analysis

Descriptive statistics, such as percentage and frequency, were reported for the IOC and MRCP test results; mean and standard deviation were reported for characteristics such as stone size, CBD size, weight, and BMI and correlated with an abnormal result on IOC. With IOC as the gold standard, sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were calculated for MRCP along with the 95% confidence intervals (CIs). All the analyses were performed in SAS 9.2 (SAS Institute Inc, Cary, NC).

Results

Over the course of the study years at this institution, 420 patients met inclusion criteria for the study and were analyzed. Of the 420 patients, 70 (16%) had preoperative MRCP. Forty-eight of the 70 patients had normal results on MRCP and IOC, 9 of 70 patients had abnormal results on MRCP and normal results on IOC, 13 of 70 patients had normal results on MRCP and abnormal results on IOC, and 5 of 70 patients had abnormal results on both MRCP and IOC. There was 1 patient who had an abnormal result on MRCP, a normal result on IOC, and a subsequent abnormal result on ERCP that was therapeutic and was performed based on worsening hyperbilirubinemia. Seventy patients were then used as the sample size to compare, and these results indicated that when compared with IOC, MRCP had a sensitivity of 27% (95% CI, 11% to 58%) and a specificity of 83% (95% CI, 69% to 91%) (Table 1). The positive predictive value of MRCP was 36% (95% CI, 5% to 85%) and the negative predictive value was 77% (95% CI, 54% to 88.9%). The accuracy of MRCP in correctly identifying CBD stones when compared with IOC was 69%.

In this study only 14 stones were obtained for pathologic evaluation. The mean size was 6 mm, ranging from 3 to 15 mm. These stones were from patients who had abnormal results on IOC. Smaller stone size in this study did not correlate with a higher rate of false normal results for MRCP. The mean CBD size was 6 mm, ranging from 2 to 17 mm. The total bilirubin level averaged .8 mg/dL, ranging from 1 to 8 mg/dL; 50% of the patients in our study with a total bilirubin level greater than 1.2 mg/dL had abnormal results on IOC, but there were 5 patients with a total bilirubin level greater than 2 mg/dL and another 2 patients with total bilirubin levels of 3.5 and 4.8 mg/dL, respectively,
who had normal results on IOC. Weight and BMI were not predictors of the rate of false normal results on MRCP, although this was seen in other studies.

Comments

In patients with clinical suspicion of choledocholithiasis, it is our preference to perform ERCP before cholecystectomy. However because of a variety of reasons, not the least of which is medicolegal pressure on gastrointestinal physicians in our institution, we have noticed an unwillingness of these physicians to perform ERCP without performing MRCP first. This has led to delay in the management of patients in whom we clinically suspect the presence of choledocholithiasis. In addition to delay, it is our impression that the addition of MRCP adds an unnecessary expense. Although most recent studies have shown that MRCP is equivalent to ERCP in detecting CBD stones, it has been our clinical impression that MRCP has a high rate of false normal results and overall is not as accurate as thought. Since IOC offers direct visualization of the CBD, we believe that IOC can be considered equivalent to ERCP as the gold standard for diagnosing CBD stones.

The results of this study were what we expected in that MRCP had a rate of false normal results much higher than previously reported. Interestingly, the total bilirubin level did not appear to correlate well with the presence of CBD stones in this study. Most notable is that in our study, BMI had no negative effect on the accuracy of MRCP.

The disadvantage of this study was that it is a retrospective study and the number of patients undergoing IOC with a correlating MRCP was small. A larger number of patients should be studied who have undergone both IOC and MRCP to better define the accuracy of MRCP compared with IOC.

Conclusions

In summary, MRCP should not be considered equivalent for detecting CBD stones when compared with techniques that directly visualize the ducts; in addition it has a lower than expected accuracy rate, which potentially adds extra costs and delays patient care.

References