

Usefulness of endoscopic ultrasound in patients at high risk of choledocholithiasis

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Background: Endoscopic retrograde cholangiopancreatography (ERCP) has been considered the nonsurgical gold standard for the diagnosis and treatment of choledocholithiasis (CDL). Complications include a 0.1% to 1.3% mortality rate and a 5% to 19% morbidity rate, including a reported 1.8% to 6.7% incidence of postprocedure pancreatitis. Twenty-seven percent to 67% of ERCPs done for suspected choledocholithiasis ultimately have negative results. Endoscopic ultrasound (EUS) has been proposed as an alternate means of diagnosing choledocholithiasis that may eliminate the need for ERCP and its associated morbidities in certain patients.

Methods: Retrospective chart review identified 30 patients who underwent EUS with or without ERCP for suspected choledocholithiasis. Reports of all procedures performed were obtained and data were collected on all biliary abnormalities identified on both EUS and ERCP.

Results: Pancreaticobiliary abnormalities were identified in 27 of 30 pa-

tients (90%) at EUS. Most common diagnoses included CDL (n = 9, 30%), biliary sludge (n = 11, 37%), pancreatitis (n = 8, 27%), and cholelithiasis (n = 7, 23%). Subsequent ERCP was performed in 14 patients (47%). Indications included a diagnosis of CDL by EUS (n = 9) and abnormal liver function tests (n = 5). CDL was identified in 5 of 14 patients (36%), and microlithiasis/biliary sludge was identified in an additional 5 patients (36%). In 4 patients, CDL was identified by EUS but not by ERCP. ERCP did not identify any new cases of CDL after EUS: of 21 patients without evidence of CDL on EUS, none were subsequently shown to have CDL or to develop any complications related to common duct stones.

Conclusions: EUS is an effective method of diagnosing CDL. It demonstrates both a high sensitivity and specificity for identifying common bile duct stones. Its use as a screening modality in patients suspected of having CDL may allow more selective use of ERCP.

Choledocholithiasis (CDL), the presence of a gallstone in the common bile duct, is a troublesome component of biliary tract disease. Its clinical spectrum is broad, with a wide range of presenting symptoms. Some patients are completely asymptomatic, others have jaundice or associated pruritus, and others have more troubling complications such as cholangitis or pancreatitis.

Endoscopic retrograde cholangiopancreatography (ERCP) has long been considered the nonsurgical gold standard for the diagnosis and treatment of CDL. ERCP involves endoscopic cannulation of the common bile duct with a side-viewing endoscope and a retrograde contrast injection. ERCP carries an associated 0.1% to 1.3% mortality rate and 5% to 19% morbidity rate (1–3), including a reported 1.8% to 6.7% incidence of pancreatitis (1, 3–5). Furthermore, of all ERCPs done for suspected CDL, 27% to 66% result in a normal examination with no stones identified (2, 6–13).

Alternatively, imaging studies can be performed to evaluate for CDL. Commonly ordered studies such as transcutaneous abdominal ultrasound and contrast-enhanced computed tomography have been unreliable at predicting the presence of CDL, especially when compared with endoscopic ultrasound (EUS) or ERCP. Abdominal ultrasound diagnosis of CDL has a reported sensitivity of 55% to 77% and a specificity of 83% to 95% (14). Studies of CDL diagnosis by computed tomography have demonstrated a sensitivity of 85% to 88% and a specificity of 88% to 97% (15, 16). Magnetic resonance cholangiopancreatography has shown promise but still has sensitivities and specificities inferior to those of ERCP (17–19).

EUS, which involves an endoscope with an ultrasonic transducer at the tip, has been proposed as an alternate means of diagnosing CDL. Ultrasound has been shown to be an excellent tool for identifying biliary abnormalities. With EUS, the transducer is within 1 to 2 cm of the common bile duct, allowing for very detailed image production. This study evaluated the use of EUS to determine its clinical utility in patients suspected of having CDL.

METHODS

An institutional review board–approved retrospective chart review identified 30 patients who underwent EUS with or without ERCP for suspected choledocholithiasis from May 2003 through October 2004. CDL was suspected based on any of the following: abnormal intraoperative cholangiogram, abnormal diagnostic imaging results, acute pancreatitis of suspected biliary origin, or elevated liver function tests. All procedures were performed by a single gastroenterologist.

All patients gave informed consent for all procedures performed (EUS and ERCP). The patients were placed in either a left lateral decubitus or prone position. An electronic Pentax EUS scope with 270-degree radial images was positioned in the duodenal bulb or the second portion of the duodenum near the

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Table 1. Results of endoscopic ultrasound in 30 patients

Diagnosis	Number (percentage)
Choledocholithiasis	9 (30%)
Microlithiasis/biliary sludge	11 (37%)
Pancreatitis	8 (27%)
Cholelithiasis	7 (23%)
Other*	4 (13%)
No abnormalities	3 (10%)

*Common bile duct stricture (2 patients), pancreas divisum, pseudocyst.

ampulla. The common bile, common hepatic, and cystic ducts as well as the gallbladder were studied. The examination was considered incomplete or equivocal if the common bile duct and common hepatic ducts were not visualized completely. ERCP was performed in all patients with suspected biliary stones, either during the same session or at a later date depending on the duration of the EUS examination and patient tolerance.

All EUS and ERCP reports were obtained, and data were collected on all biliary abnormalities identified. Outpatient follow-up data were obtained from review of records from subsequent office visits.

RESULTS

Pancreaticobiliary abnormalities were identified in 27 of 30 patients (90%) at EUS. Most common diagnoses included CDL (n = 9, 30%), microlithiasis/biliary sludge (n = 11, 37%), pancreatitis (n = 8, 27%), and cholelithiasis (n = 7, 23%) (Table 1). There were no complications as a result of EUS.

Subsequent ERCP was performed in 14 patients (47%). Indications for ERCP included a diagnosis of CDL by EUS (n = 9) and abnormal liver function tests (n = 5). CDL was identified in 5 of 14 patients (36%) and microlithiasis/biliary sludge was found in an additional 5 patients (36%) (Table 2). In 4 patients, CDL was identified by EUS but not by ERCP. ERCP did not identify any new cases of CDL after EUS: of 21 patients without evidence of CDL on EUS, none were subsequently shown to have CDL or to develop any complications related to common duct stones.

EUS was found to have 100% sensitivity and 84% specificity for the detection of CDL. The positive and negative predictive values for detection of CDL were 56% and 100%, respectively. Overall, 16 of 30 patients (53%) with suspected CDL did not require ERCP.

DISCUSSION

The results of this study provide early evidence that EUS is a highly effective means of diagnosing CDL. All patients with CDL were accurately identified by EUS. As a result, 53% of patients in our study were spared ERCP. In fact, given that all patients without evidence of CDL on EUS went on to have negative follow-up results and/or ERCP, 70% of patients in our study could have avoided ERCP if selection criteria had been more strict. These data are in agreement with numerous other studies demonstrating rates of negative ERCPs of 27% to 66% in patients with suspected CDL (2, 6–13).

Table 2. Results of endoscopic retrograde cholangiopancreatography in 14 patients

Diagnosis	Number (percentage)
Choledocholithiasis	5 (36%)
Microlithiasis/biliary sludge	5 (36%)
Common bile duct stricture	1 (7%)
Cholesterol crystals	2 (14%)
Other*	3 (21%)
No abnormalities	0 (0%)

*Biliary papillary stenosis (2 patients), common bile duct stricture.

EUS has been shown to have excellent sensitivity (84%–100%) and specificity (90%–100%) in a number of prospective trials (11–13, 20–23). In our study, EUS demonstrated 100% sensitivity and 84% specificity, with a 100% negative predictive value. Four patients with CDL identified on EUS in our study did not have CDL confirmed on ERCP, resulting in a positive predictive value of 56%. These represent either false-positive exams or stones that had passed in the interval between EUS and ERCP exams, most of which were performed at a separate setting. Another possibility is that the small stones visible by ultrasound were obscured by contrast during the ERCP. In fact, one patient was found to have CDL by EUS with a negative cholangiogram at ERCP. Based on the EUS identification of the stone, a sweep of the common duct with a balloon retrieved this small stone, which was visible only after it had passed through the ampulla. Regardless, the use of EUS as an effective screening modality for CDL is confirmed by our study's 100% sensitivity and 100% negative predictive value.

Additionally, no patients in our study suffered any EUS-related complications. Certainly, this procedure is invasive, requires sedation, and has complication rates similar to those seen with simple esophagogastroduodenoscopy. The risk of pancreatitis following EUS, however, is essentially zero. A zero-complication rate has been noted in multiple other series of EUS (11–13, 20–23). This is in contrast to the well-known complications of ERCP. Published incidences of post-ERCP pancreatitis range from 1.8% to 6.7%, with an overall morbidity rate of 5% to 19% (1–5). Certainly, complications are of particular concern in this group of patients, many of whom presented with acute pancreatitis. Given the complication rates of EUS and ERCP along with the potentially serious morbidity and mortality of pancreatitis, further justification is provided for use of EUS as the initial diagnostic imaging modality in patients with suspected CDL.

EUS will not replace ERCP, in that ERCP is the therapeutic procedure of choice for patients with CDL. In fact, ERCP should be considered in all patients with suspected CDL and elevated bilirubin. As experience with EUS is obtained, however, patients whose biliary systems are felt to be at too high risk for ERCP (e.g., acute pancreatitis, necrotizing pancreatitis) can be evaluated in an expeditious manner using EUS, and those with positive findings mandating ERCP can receive intervention while those with negative findings can be followed.

In summary, EUS is an effective method of diagnosing CDL. It demonstrates both a high sensitivity and specificity for identifying common bile duct stones. Its use as a screening modality in patients suspected of having CDL may allow more selective use of ERCP.

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