The efficacy of endoscopic ultrasound for the diagnosis of common bile duct stones as compared to CT, MRCP, and ERCP

Biliary stone disease is one of the most common medical conditions that can lead to hospitalization and surgical intervention. Cholelithiasis develops in approximately 10–20% of patients with gallbladder stones, while approximately 3–10% of patients undergoing cholecystectomy will have common bile duct (CBD) stones. The CBD stones can cause cholangitis, obstructive jaundice, acute pancreatitis and sepsis. Therefore, accurately diagnosing cholelithiasis is important for clinical decision making. Clinical predictors for cholelithiasis include elevated bilirubin, clinical ascending cholangitis or gallstone pancreatitis, and dilated CBD on transabdominal ultrasound (US). However, clinical presentations and biochemical tests are often insufficient, and imaging studies are always necessary to confirm the diagnosis. Currently, abdominal US, endoscopic ultrasonography (EUS), computed tomography (CT), CT cholangiography, magnetic resonance cholangiopancreatography (MRCP), and intraoperative fluorocholangiography are available imaging modalities for the detection of CBD stones.

In most hospitals, abdominal US and CT are still the threshold imaging studies for patients with abdominal pain. However, the sensitivity of transabdominal US for detection of CBD stones is only 26%. The sensitivity and specificity of unenhanced helical CT in detecting CBD stones is reported to be 50–88% and 84–98%, respectively. The multi-slice CT has resulted in a transformation from cross-section imaging to true three-dimensional images. Reconstruction CT images have become routine in clinical practice; however, the coronal reconstruction of CT imaging did not increase its diagnostic efficacy on choledocholithiasis. Primarily, stone size affects the diagnostic rate of abdominal CT for detecting choledocholithiasis. The CT diagnostic rate was significantly lower in patients with choledocholithiasis of less than 5 mm than in patients with choledocholithiasis of 5 mm or more (56.5% vs. 81.2%).

MRCP can also provide excellent anatomical detail of the biliary and pancreatic ducts, thus increasing the diagnostic efficacy of CBD stones. MRC was reported to have 85–92% sensitivity and 93–97% specificity for detection of choledocholithiasis. However, the stone size also affects the diagnostic rate of MRC for choledocholithiasis. The sensitivity decreased to 33–71% in the setting of small CBD stones (<6 mm). In clinical practice, this noninvasive imaging study is expensive, it requires significant expertise for interpretation, and the equipment may not always be readily available.

In the era of open cholecystectomy there was no advantage for preoperative ERCP over operative cholangiography and common duct exploration. Currently, ERCP is an established standard for diagnostic procedure for CBD stones. However, it is invasive and may cause several complications including acute pancreatitis (1.3–6.7%), biliary tract infection (0.6–5%), bleeding (0.3–2%), and duodenal perforation (0.1–1%). The sensitivity of ERCP with cholangiography alone is reported to be 89–93% when subsequent sphincterotomy and duct sweeping with a balloon or basket were used as the standard criterion. Sandy stones in dilated CBD may be the major reason for false-negative ERCP findings when using cholangiography.

EUS is less invasive than ERCP and was reported to be an efficient diagnostic tool for CBD stones given the close proximity of extrahepatic bile duct to the proximal duodenum. A meta-analysis assessing EUS performance in suspected cholelithiasis of 2673 patients in 27 studies showed high overall sensitivity of 94% and specificity of 95%, as compared to ERCP, intraoperative cholangiography, or surgical exploration as criterion standards. In contrast to CT and MRC, the sensitivity of EUS for diagnosing CBD stones was not affected by small size of stones (<5 mm). EUS was reported to be more sensitive than ERCP in detecting CBD stones smaller than 4 mm (90% vs. 23%). EUS should, therefore, be used to select patients for therapeutic ERCP to minimize the risk of complications associated with unnecessary diagnostic ERCP. However, EUS has some limitations. It is difficult in patients with periampullary diverticula or distortion of the duodenal bulb caused by duodenal ulcer disease. Detection of a stone impacted at the papilla by EUS can be difficult.

In the current issue of *Journal of the Chinese Medical Association*, Lin and Huang reported the usefulness of linear EUS for detection of CBD stones in clinically suspected patients, where the stones were not detected by prior US or CT imaging. They collected 30 patients retrospectively and showed that the sensitivity, specificity, positive predictive value, negative predictive value, and accuracy were 100%, 94.7%, 91.7%, 100%, and 96.7%, respectively, for detection of
CBD stones. Nevertheless, the diagnostic value of EUS for choledocholithiasis in this report may be overestimated for several reasons. First, 17 out of 30 patients did not receive ERCP, intraoperative cholangiography, or surgical exploration as criterion standards. Second, patients whose EUS endoscope insertion into duodenum failed were excluded. In this study, one patient with multiple large CBD stones underwent surgery and a patient with gallbladder cancer was diagnosed by abdominal CT and ERCP thereafter.14 Furthermore, EUS may have been obviated if abdominal CT had been done before EUS in these two patients.

Comparing EUS-first, ERCP-second strategy and ERCP-only strategy in patients with intermediate to high risk of choledocholithiasis, the EUS-first strategy was reported to eliminate the need for 60–73% of ERCP and to be cost-effective.2 In the study of Lin and Huang, they reduced the need for ERCP procedure by 44% and 85% in high- and intermediate- risk groups of choledocholithiasis, respectively.14 Radial array echoendoscopes are more frequently used by many endosonographers due to elongated views of the bile duct. However, linear array instruments can also provide excellent performance for choledocholithiasis, with both sensitivity and specificity of 93%.8 Lin and Huang also obtained a comparable result.14

A suggested evaluation and management algorithm for patients with suspected choledocholithiasis is shown in Fig. 1. The algorithm may be modified by local availability of expertise and facilities. CT or MRCP was less invasive than EUS. MRC is preferred if no contraindication is present, because the sensitivity of MRC is superior to CT for detection of CBD stones. When MRC or CT is negative, EUS is recommended to check for small CBD stones.

In conclusion, EUS is a noninvasive test with excellent overall sensitivity and specificity for diagnosing choledocholithiasis. EUS should be used to select patients for therapeutic ERCP in order to eliminate unnecessary diagnostic ERCP.

Fig. 1. A suggested evaluation and management algorithm for patients with suspected choledocholithiasis.

References