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Can ultrasound common bile duct diameter predict common bile duct stones in the setting of acute cholecystitis?

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Abstract

BACKGROUND: Our aim is assessment of ultrasound (US) common bile duct (CBD) diameter to predict the presence of CBD stones in acute cholecystitis (AC).

METHODS: A retrospective review from 2007 to 2011 with codes for ultrasound, magnetic resonance cholangiopancreatography (MRCP), endoscopic retrograde cholangiopancreatography, and AC was conducted.

RESULTS: The incidence of CBD stones was 1.8%. Two hundred forty eight individuals had US+MRCP+ERCP+AC, of which 48 had CBD stones and 200 did not have CBD stones. US CBD diameter range was 3.6 to 19 mm. Ninety percent of MRCPs were negative, and it delayed care by 2.9 days. Mean CBD diameter was narrower in those negative for CBD stones (5.8 vs 7.08; $P = .0043$). Groups based on diameter ranges <6, 6 to 9.9, and ≥ 10 mm demonstrated 14%, 14%, and 39% CBD stones, respectively.

CONCLUSIONS: US CBD diameter is not sufficient to identify patients at significant risk for CBD stones. MRCP delayed care by 2.9 days. Intraoperative cholangiography may be more effective, based on the low risk of CBD stones in AC.

Because the right upper quadrant abdominal ultrasound (US) is commonly the first diagnostic imaging tool for patients presenting with signs and symptoms of acute cholecystitis (AC), it is essential to understand the diagnostic limitations to the study in the acute setting. The incidence of common bile duct (CBD) stones in patients undergoing cholecystectomy has been reported as 3% to 18%.[1,2] Although abdominal US can frequently provide data regarding the CBD diameter, the accurate visualization of CBD stones can be impacted by both patient factors and the technical skill of the ultrasonographer. Reliance on CBD diameter as a surrogate for choledocholithiasis is associated with a sensitivity ranging from 50% to 90% with a CBD diameter <6 mm using abdominal US.[3,4] The majority of the available studies have been predominantly based on elective surgical populations with limited percentages of AC patients.[5] The associated risk of abdominal distention and the degree of associated inflammation in the area could impact the accuracy of US.

The authors declare no conflicts of interest.

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Table 1 Study population demographics

Category	AC	AC+MRCP/ERCP
Individuals (*n*)	2,588	248
Men	890 (34%)	78 (31.50%)
Women	1,696 (66%)	170 (68.50%)
Average age (y)	42 ± 14.3	41 ± 14.5
Age range (y)	15–97	16–89
Average age of men (y)	44 ± 14	43 ± 13.4
Average age of women (y)	41 ± 14.3	40 ± 14.8

Data are expressed as number (percentage).

AC = acute cholecystitis; ERCP = endoscopic retrograde cholangiopancreatography; MRCP = magnetic resonance cholangiopancreatography.

It is essential to identify the AC patient at risk for choledocholithiasis because a decision will need to be made regarding the approach to both the gallbladder and the potential clearance of the CBD. The options have differing cost and risk and include the following: (1) laparoscopic cholecystectomy; intraoperative cholangiogram, directed open/laparoscopic CBD exploration; (2) laparoscopic cholecystectomy; intraoperative cholangiogram, postoperative endoscopic retrograde cholangiopancreatography (ERCP); (3) magnetic resonance cholangiopancreatography (MRCP); directed ERCP if stone seen, same admission laparoscopic cholecystectomy; or (4) ERCP based on US suspicion, same admission laparoscopic cholecystectomy. Therefore, accurate prediction of CBD stones in AC avoids the well-documented increased time to surgery, operative complications, morbidity, length of hospital stay, and increased overall cost associated with additional imaging studies beyond US.[6] The aim of this study is to determine the impact of abdominal US diameter on the prediction of CBD stones in patients with AC.

Methods

All charts of the patients who were seen at Los Angeles County–University of Southern California Hospital from 2007 to 2011 with diagnostic codes including AC (474.00 to 575.12) and procedure codes for preoperative MRCP and preoperative ERCP were reviewed retrospectively. Institutional Review Board approval was obtained from the University of Southern California. Data were extracted from electronic medical records and entered in a protected fashion in Microsoft Excel 2007 (Microsoft Corporation, Redmond, Washington). All patients underwent US at the time of diagnosis. The decision to proceed with additional imaging versus initial laparoscopic cholecystectomy with or without intraoperative cholangiogram (IOC) was at the discretion of the treating surgical team. The decision to perform additional imaging was based on either chemistries or suspicion on US. All measurements of CBD diameter were taken from sonograms performed at the time of admission and recorded in millimeters. Preoperative MRCP and ERCP were classified as positive, negative, or equivocal for CBD stones based on staff radiologist reads and/or endoscopy report. All statistical analyses were carried out using SPSS version 20 (SPSS IBM, New York, NY). Comparison of means among groups was performed using independent samples *t* test, while comparisons of categorical variables was performed using the chi-square test. A *P* value of $<.05$ was considered significant.

Results

The total number of individuals with AC was 2,588. Thirty-four percent (890/2,588) of patients were men and 66% (1,696/2,588) were women. The average age of the AC population was 42 years (Table 1).

There were 248 individuals with AC and suspected CBD stones who underwent preoperative MRCP, ERCP, or both. The male population comprised 31.5% (78/248) of patients with an average age of 43 years. The female population comprised 68.5% (170/248) of patients with an average age of 40 years. The overall age range for this group was 16 to 89 years (Table 1). Forty-eight of 248 individuals (19%) were found using abdominal US, MRCP, or ERCP to have CBD stones and AC. The overall incidence of choledocholithiasis in our population of AC was 48/2,588 (1.8%). The diagnosis of choledocholithiasis based on abdominal US was 10/248 (4%) with 8/10 having documented stones at ERCP. There were 226 MRCPs performed based on clinical suspicion or US diameter and 22/226 (9.7%) were positive for CBD stones and 14/22 had documented CBD stones using ERCP. Importantly, the liberal use of MRCP was associated with a negative result in 204/226 (90.3%).

There were 19 clinically directed initial ERCPs performed and 15/19 (78%) were positive. Eight patients were performed for choledocholithiasis found using abdominal US. Three ERCPs were performed based on elevated total bilirubin tests/liver function tests (LFT) and CBD diameter >6 mm. Four ERCPs were performed based on elevated total bilirubin tests/LFT, 2 were performed for CBD diameter enlargement (8.3 and 9 mm) and 1 ERCP was because of choledocholithiasis found using computed tomography scan.

Abdominal ultrasound common bile duct diameter assessment

The mean CBD diameter in individuals with no CBD stones was significantly narrower compared to AC patients with documented CBD stones (5.8 ±2.3 vs 7.08 ± 3.4 mm; $P = .0043$, 95% confidence interval (CI) 2.02 to .38). In the population of patients who did not have choledocholithiasis diagnosed using US, the distribution of CBD diameter groups of patients and the incidence of ERCP or IOC confirmed that CBD stones were <6 (9%), 6 to 9.9 (13%), and ≥ 10 mm (38%) within the population, and <6 (69%), 6 to 9.9 (69%) and ≥ 10 mm (86%) for the