

Choledochal or pancreatic cyst? Role of endoscopic ultrasound as an adjunct for diagnosis: a case series

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Abstract

Background Choledochal cysts (CC) are a cystic dilation of the intra- or extrahepatic biliary tree. They are rare, and are associated with a risk of malignant transformation. Due to the close proximity to the pancreas, Type II CC, in which a diverticular outpouching is connected to the extrahepatic bile duct via a narrow stalk, can be difficult to differentiate from pancreatic cysts. The aim of this study was to determine the role of endoscopic ultrasound (EUS) in the diagnosis of Type II CC.

Methods A retrospective review of all patients seen in the Multidisciplinary Pancreatic Cyst Clinic at Johns Hopkins Hospital from November 2010 to March 2014 was performed to identify patients classified as having Type II CC on computed tomography (CT) or magnetic resonance imaging (MRI) who also underwent EUS. Patient

demographics, clinical presentation, imaging, and follow-up were recorded.

Results Four female patients with median age of 52 years, three of whom were identified as having Type II CC and one as equivocal for CC on MRI, and two as having Type II CC, one equivocal for CC and one as branch-duct intraductal papillary mucinous neoplasm on CT. On EUS, no communication was seen in any cases between the CC and common bile duct. EUS-guided fluid aspiration from each cyst demonstrated clear fluid with undetectable bilirubin and either elevated CEA or amylase confirming the diagnosis of pancreatic cyst.

Conclusions EUS is a useful tool for the differentiation of equivocal cases of CC. It can show a very small separation as little as 1 mm between two structures, and cyst fluid analysis can be performed and used to further differentiate between biliary cysts and other cystic structures.

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Keywords Pancreatic cysts · Choledochal cysts · Endoscopic ultrasound · Fine needle aspiration

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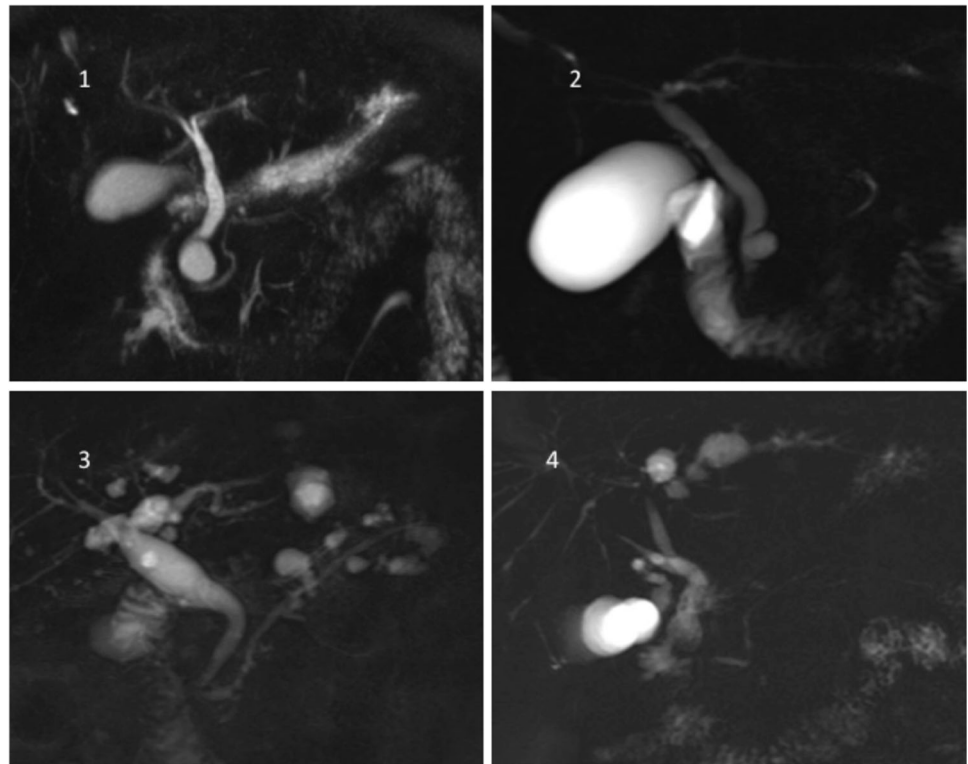
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Choledochal cysts (CC) are cystic dilation of the intrahepatic or extrahepatic biliary tree. They are classified into five different subtypes based on their location and distribution within the biliary tree [1]. Type I is a dilation of the common bile duct (CBD); Type II, is a diverticular outpouching from the CBD; Type III is a cystic dilation of the distal CBD within the ampulla of Vater; Type IV consists of multiple dilations involving the intrahepatic and/or extrahepatic biliary tree; and Type V (Caroli's disease) is cystic dilation confined to the intrahepatic biliary tree (Fig. 1).

CC are rare, with a worldwide incidence of 1 in 100,000 to 1 in 150,000 [1]. Historically, they frequently presented

Fig. 1 MRCP images of the subtypes of choledochal cysts.
1 Type I choledochal cyst;
2 Type II choledochal cyst;
3 Type IV choledochal cyst;
4 Type V choledochal cyst



in children with jaundice, right upper quadrant pain and an abdominal mass. However, recent studies have shown a higher prevalence among adults whose only presenting symptom is abdominal pain [2]. One of the most feared complications of CC is cholangiocarcinoma, with an incidence of 6–11 % [2–4]. Given the risk of malignant transformation, surgical resection is recommended for patients with Type I, II, and IV CC [5].

Computed tomography (CT)/computed tomography cholangiography (CTC) and magnetic resonance imaging (MRI)/magnetic resonance cholangiopancreatography (MRCP) are most frequently used to identify CC, with very high sensitivities of 90–100 % reported [6, 7]. However, Type II CC, where a diverticular outpouching is connected to the extrahepatic bile duct via a narrow stalk, can be difficult to differentiate from pancreatic cysts within the head of the pancreas which lie close to the intrapancreatic portion of the bile duct. The aim of this study was to determine the role of endoscopic ultrasound (EUS) in the diagnosis of Type II CC.

Materials and methods

Clinical and radiological data were prospectively collected on patients who attend the Multidisciplinary Pancreatic Cyst Clinic and entered into a database [8]. A retrospective review of data collected from November 2010 to March

2014 was performed to identify patients classified as having Type II CC on either CT or MRI/MRCP, who also underwent EUS. Patient demographics, clinical presentation, imaging, and follow-up were recorded. Ethical approval for this study was obtained from the Institutional Review Board for Human Research and the study complied with Health Insurance Portability and Accountability Act (HIPAA) regulations.

Results

There were 822 patients seen in the Multidisciplinary Pancreatic Cyst Clinic from November 2010 to March 2014; 564 patients underwent EUS and CT or MRI. We identified four patients in whom the initial diagnosis of Type II CC was made on either CT or MRI/MRCP and an alternate diagnosis was made based on EUS. All four patients were female with a median age of 52 (range 31–65) years. Two presented with right upper quadrant pain and the other two were asymptomatic (Table 1); all four patients underwent CT, MRI/MRCP, and EUS. MRI/MRCP classified three cysts as Type II CC, and as equivocal in one case, while CT identified two cysts as a Type II CC, one as equivocal for Type II CC and one as a branch-duct intraductal papillary mucinous neoplasm (BD-IPMN) (Video 1). On EUS there was no communication identified between the cysts and the extrahepatic bile duct (Video 2),

suggesting that these cysts were pancreatic, rather than biliary in origin in all four patients. EUS-guided fine needle aspiration (EUS-FNA) was performed in all cases, and revealed clear fluid with no evidence of bile staining consistent with a non-biliary origin. In addition, in one case bilirubin level was tested and was undetectable. Cyst fluid analysis (Table 1) showed a CEA <0.5 ng/mL, consistent with a serous cystadenoma in two cases [9]. The two other cases were diagnosed as BD-IPMN based on either a cyst fluid CEA >192 ng/mL or the presence of mucin on cytology [10]. One patient underwent surveillance with no change in the cyst size or features over a 3 year period and another had an increase in cyst size over a year period but no evidence of malignancy on repeat EUS-FNA. The other two patients were followed locally.

Discussion

EUS can help confirm the presence of a choledochal cyst by identifying a long common pancreaticobiliary channel

[11, 12]. However, to our knowledge, this is the first study to highlight the role of EUS in discriminating Type II CC from pancreatic cysts. This differentiation is critical, as the management of pancreatic cysts is often entirely different to CC. Two of the cysts in this series were serous cystadenomas, which have a very low risk of malignant transformation of less than 1.5 %, with surgery only performed in symptomatic patients, or when differentiation from a mucinous cyst with concerning features is not possible [13, 14]. The other two cysts were BD-IPMNs which have the potential to progress to high-grade dysplasia or invasive adenocarcinoma; however that risk is small, and in the absence of any worrisome or suspicious features, international consensus guidelines recommend surveillance of the cysts [15]. In contrast, surgery is recommended for all patients with Type II CC due to the risk of cholangiocarcinoma, which occurs in 6–11 % of patients [2–4]. Thus, differentiating CC from pancreatic cysts is critical to identify those patients with CC in whom surgical resection is recommended, from patients with pancreatic cysts in whom surveillance is appropriate.

Table 1 Imaging and cyst analysis results

Patient	1	2	3	4
Cyst size, cm	1.4	1.7	2.9	3.3
Cyst features	Single cyst No septations No solid component	Single cyst No septations No solid component	Single cyst Septated No solid component	Single cyst No septations No solid component
Symptoms	None	Abdominal pain	Abdominal pain	None
CT				
Cyst communication with the bile duct	No	Yes	Equivocal	Yes
Diagnosis	Side-branch IPMN	Type II choledochal cyst	CC cyst vs choledochal cyst	Type II choledochal cyst
MRI				
Cyst communication with the bile duct	Yes	Yes	Equivocal	Yes
Diagnosis	Type II choledochal cyst	Type II choledochal cyst	Choledochal cyst or pancreatic cyst.	Type II choledochal cyst
EUS				
Cyst communication with the bile duct	No	No	No	No
Diagnosis	Pancreatic cyst	Pancreatic cyst	Macrocystic serous cystadenoma	Pancreatic cyst
Cyst fluid				
Color	Clear	Clear	Clear	Clear
CEA ng/mL	88	241.5	<0.5	<0.5
Bilirubin mg/dL	–	<0.1	<0.1	–
Cytology	Mucinous epithelium	Mucinous epithelium	Benign columnar cells	Benign columnar cells
Final Diagnosis	BD-IPMN	BD-IPMN	Serous cystadenoma	Serous cystadenoma

IPMN intraductal papillary mucinous neoplasm, BD-IPMN branch-duct intraductal papillary mucinous neoplasm

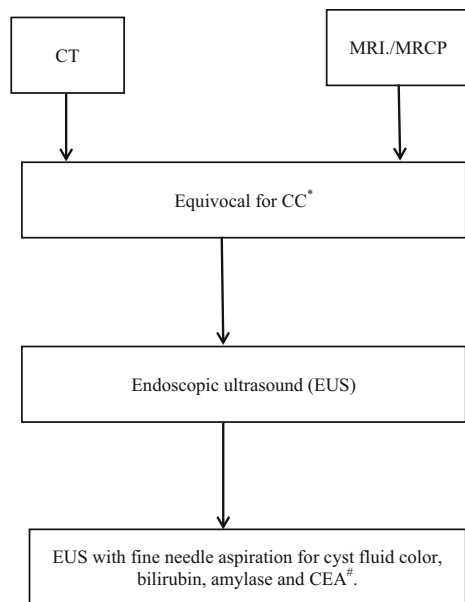


Fig. 2 Algorithm for the diagnosis of equivocal cases of choledochal cysts (CC). *Asterisk* equivocal for CC: the radiologists cannot confidently demonstrate choledochal communication with the cyst. *Ash* CEA: carcinoembryonic acid

Studies have shown MRI/MRCP as the best test to identify CC with sensitivities of 96–100 % [6, 7, 16]; however, it is less accurate at detecting an aberrant pancreaticobiliary junction, one of the hallmarks of CC, with sensitivities as low as 53 % reported [7]. This may be because despite its high resolution, the images are static. In addition, image quality can be impaired if patients are unable to perform breath holding. EUS has been shown to be superior to MRI and CT for the identification of small pancreaticobiliary lesions [17]. It is particularly good at visualizing the distal bile duct, and is superior to MRI for the identification of small (<5 mm) CBD stones [18]. This may be due to visualization of lesions as small as 2 mm. In addition, EUS images are dynamic and allow better visualization of the presence or absence of a small communication between the cyst and CBD (Video 2). Furthermore, EUS-FNA can be performed which allows assessment of cyst fluid. Bile duct fluid can easily be differentiated from pancreatic juice based on its color (Video 2), with the absence of bilirubin providing further evidence of a non-biliary origin for the cyst. Based upon our experience, we propose an algorithm (Fig. 2) in which patients with an equivocal diagnosis of CC on transabdominal imaging studies can be considered for assessment with EUS and EUS-FNA.

This study has limitations that should be considered when interpreting the results. It is a single center, retrospective study. Although this is the largest number of

patients in whom the role of EUS in CC has been reported, the numbers are still small. There may be a bias in the patient selection, as only cases in which the diagnosis was unclear may have been referred for EUS.

In conclusion, this study highlights the role of EUS as an adjunct to CT or MRI/MRCP in cases of presumed Type II CC where the diagnosis may be equivocal.

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