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# Incidentally detected biliary ductal dilatation on contrast-enhanced CT: what is the incidence of occult obstructing malignancy?

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## Abstract

**Purpose** The purpose of this study was to determine the incidence of occult obstructing malignancy in the setting of asymptomatic biliary ductal dilatation incidentally detected and without identifiable cause on contrast-enhanced CT.

**Methods** A retrospective search identified patients with biliary ductal dilatation on contrast-enhanced CT from March 30, 2007 to November 1, 2017. Patients with biliary symptomatology or clinical concern for an obstructing process, an explanation for biliary ductal dilatation on index CT, intrahepatic without extrahepatic biliary ductal dilatation, concurrent pancreatic ductal dilatation, and inadequate follow-up were excluded. A reference standard of at least 1 year of imaging follow-up or 2 years of clinical follow-up was used to exclude occult obstructing malignancy.

**Results** 156 patients were included; 120 patients met imaging follow-up criteria and 36 patients met clinical follow-up criteria. No cases of occult malignancy were identified as the source of biliary ductal dilatation (95% CI 0.0–1.9%). LFTs were available for 131 patients, of which 36 were elevated (27%). One case demonstrated a 1.2-cm ampullary adenoma on endoscopic retrograde cholangiopancreatography (occult on follow-up MRI, normal LFTs at the time of the index CT).

**Conclusion** Asymptomatic biliary ductal dilatation incidentally detected and without identifiable cause on contrast-enhanced CT is likely benign in patients with normal LFTs, and further workup may not be warranted.

**Keywords** Biliary ductal dilation · Incidental · Malignancy · Bile ducts

## Introduction

Incidental biliary ductal dilatation without an identifiable etiology is a common finding on contrast-enhanced CT [1]. Biliary ductal dilatation can be secondary to benign processes such as choledocholithiasis or sphincter of Oddi dysfunction. However, malignant processes, including tumors of the bile duct, pancreatic head, and ampulla are also sources of biliary dilation. There is limited literature on the appropriate management of incidental biliary ductal dilatation in asymptomatic patients. A white paper from the American College of Radiology addressing incidental biliary ductal dilatation suggests that liver function tests (LFTs) be used to guide management, with no further imaging required in the setting of normal LFTs [2]. Conversely, a few studies in the gastroenterology literature have identified clinically significant obstructive lesions even in the setting of normal LFTs [3, 4]. This discrepant evidence often results in further imaging with magnetic resonance cholangiopancreatography or invasive testing with endoscopic ultrasound (EUS) or endoscopic retrograde cholangiopancreatography (ERCP).

Further delineation of the causes of incidental asymptomatic biliary ductal dilatation, particularly the incidence of malignancy that is occult on CT, is necessary to guide management of this finding. Therefore, the purpose of this study was to determine the incidence of occult obstructing malignancy in the setting of asymptomatic biliary ductal dilatation incidentally detected and without identifiable cause on contrast-enhanced CT.

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## Materials and methods

### Patient population

This retrospective study received institutional review board approval and was HIPAA compliant. A waiver of informed consent was obtained owing to the study's retrospective nature. We performed a search of the radiology database for patients over 18 years of age who underwent contrast-enhanced CT of the abdomen from July 1, 2012 to November 1, 2017. We searched for the keywords "dilated" or "dilatation" in close association with "extrahepatic," "common," or "CBD" and identified the first study in patients with multiple examinations (earliest study March 30, 2007). This search yielded 1016 reports. The reports and electronic medical record were reviewed for each patient to exclude those with biliary symptomatology (right upper quadrant or epigastric pain, concern for cholangitis) or clinical concern for an obstructing process (jaundice) ($n=323$), an explanation for biliary ductal dilatation on index CT ($n=215$), intrahepatic without extrahepatic biliary ductal dilatation ($n=19$), concurrent pancreatic ductal dilatation $\geq 3$ mm in diameter ($n=148$), and lack of reference standard ($n=155$). A reference standard of at least 1 year of imaging follow-up or 2 years of clinical follow-up was used to exclude occult obstructing malignancy. The final study group comprised 156 patients (27 males, 129 females) with a mean age of 61 years.

### Imaging technique

#### CT

Examinations were performed on a variety of MDCT equipment due to the length of the study. MDCT scanners included GE Healthcare 4-, 16-, and 64-MDCT scanners and Siemens Healthcare 64- and 128-MDCT scanners. All scans were obtained at a fixed voltage of 120 kV. With the exception of the GE Healthcare 4-MDCT scanner, a variable tube current–time product was used for all scans obtained with automated dose modulation. The pitch varied across the scanners. The slice thickness and interval were each 5 mm. Iohexol (Omnipaque 350, GE Healthcare) was injected intravenously at a dose of 100–150 mL through a power injector at a rate of 2–4 mL/s.

#### MRI

All MRI examinations were performed on a 1.5-T system (Signa, GE Healthcare) with a phased-array torso coil. All patients fasted for at least 4 h before the examination. The imaging protocol varied, but all examinations included transverse T2-single shot fast spin echo (SSFSE) (field of view (FOV), 32 cm; slice thickness, 5 mm; spacing, 6 mm; repetition time (TR), 2400 ms; echo time (TE), 90 ms; flip angle (FA), 90; matrix, $288\times192$), coronal T2-SSFSE (FOV, 42 cm; slice thickness, 5 mm; spacing, 6 mm; TR, 2400 ms; TE, 90 ms; FA, 90; matrix, $288\times192$), and transverse T2-fast spin echo (FOV, 32 cm; slice thickness, 5 mm; spacing, 6 mm; TR, 1000 ms; TE, 82 ms; FA, 90; matrix, $256\times192$). For MRCP examinations, 3D fast relaxation fast spin echo coronal T2-weighted MRCP (FOV, 38 cm; slice thickness, 3.0 mm; spacing, 1.5 mm; TR, 1283.3 ms; TE, 427.5 ms; FA, 90; matrix, $256\times160$), 2D thick slab T2-weighted MRCP (FOV, 36 cm; slice thickness, 40 mm; spacing, 40 mm; TR, 5000.0 ms; TE, 1424.2 ms; FA, 90; matrix, $384\times224$) were used. For contrast-enhanced examinations, transverse pre- and post-contrast T1-weighted 3D spoiled gradient echo pulse (LAVA) sequence (FOV, 36 cm; slice thickness, 5.0 mm; spacing, 2.5 mm; TR, 3.2 ms; TE, 1.4 ms; FA, 12; matrix, $288\times192$) were used. Post-contrast imaging was acquired during the late hepatic arterial, portal venous, and equilibrium (2–3 min post injection) phases after intravenous administration of 0.1 mmol/kg of gadodiamide (Omniscan, GE Healthcare) at 2 mL/s.

### Imaging analysis

A single radiology resident reviewed all cases to measure the extrahepatic bile duct diameter (short-axis maximum diameter in the coronal plane) on the index CT and the latest follow-up CT or MRI. Biliary ductal dilatation was defined as a common bile duct or common hepatic duct diameter > 6 mm if the gallbladder was present and the patient was < 60 years old with or without intrahepatic ductal dilation. If the patient was ≥ 60 years old, 1 mm was added to the upper limit for every additional decade of life over 60 years. If the gallbladder was absent, biliary ductal dilatation was defined as an extrahepatic bile duct diameter > 10 mm for all ages [2, 5–7].

#### Index examination

The index examination was a contrast-enhanced CT abdomen in 156 patients obtained in the portal venous phase ($n=153$) or arterial phase ($n=3$).

#### Imaging follow-up

At least 1 year of imaging follow-up was obtained in 120 patients with the latest follow-up study a contrast-enhanced CT abdomen in 110 patients and MRI abdomen in 10 patients. Five of the MRIs were contrast-enhanced MRCPs, 3 were MRCPs without contrast, and 2 were contrast-enhanced abdominal MRIs without MRCPs. 22

patients had both CT and MRI follow-up (94 patients CT only, 4 patients MRI only, 22 patients MRI and CT). The radiology reports from these examinations were reviewed to identify any etiology of biliary obstruction. The mean time between the index study and latest follow-up study was 3.6 years (range 1.0–8.3 years). 13 patients also underwent ERCP and/or EUS. Follow-up ERCP/EUS reports were reviewed to assess for obstructing lesions.

### Clinical follow-up

Clinical follow-up was assessed by review of the electronic medical record of all 156 patients, including 36 patients who did not meet imaging follow-up criteria (less than 1 year of imaging follow-up) but had greater than 2 years of clinical follow-up (clinical follow-up-only group). Clinical notes describing the patients' current medical problems were reviewed for the presence of malignancy that could serve as a source of biliary obstruction.

For the 120 patients who had greater than 1 year imaging follow-up, the mean length of clinical follow-up was 4.7 years (range 1.1–11.2 years). For the 36 patients in the clinical follow-up-only group, the mean length of clinical follow-up was 3.7 years (range 2.1–6.3 years).

### Laboratory evaluation

LFTs were available within 3 months of the index CT for 131 patients. This included alkaline phosphatase, total bilirubin, and direct bilirubin for 116 patients and alkaline phosphatase and total bilirubin for 15 patients. LFTs were considered elevated if one or more laboratory value was above the upper limit of the institutional normal reference range (alkaline phosphatase 115 U/L, total bilirubin 1.3 mg/dL, direct bilirubin 0.2 mg/dL).

### Statistical analysis

The one-sided 95% confidence interval was calculated using the binomial exact method.

## Results

Demographics and length of follow-up for the overall cohort, imaging follow-up group, and clinical follow-up-only group are presented in Table 1. No cases of occult malignancy were identified as the source of biliary ductal dilatation based on imaging and/or clinical follow-up (0%, 95% CI 0.0–1.9%) (Fig. 1).

One case demonstrated a 1.2 cm ampullary adenoma on ERCP. This was occult on follow-up MRI, and the patient had normal LFTs at the time of the index CT. The biliary ductal dilatation decreased after endoscopic resection, with mild residual dilatation on subsequent imaging.

Three cases demonstrated choledocholithiasis on follow-up, all diagnosed with MRI and confirmed with ERCP (0.4, 3.9, 8.0 years after index CT). Two had elevated LFTs at the time of the index CT. However, all three patients had developed new biliary symptoms after the index CT, prompting an MRI examination showing choledocholithiasis. In addition, one case had an MRI after the index CT, but preceding the onset of symptoms, showing no choledocholithiasis.

87 of the 156 patients were status post cholecystectomy (56%). LFTs within 3 months of index CT were available for 131 patients, of which 36 were elevated (27%). Overall, 120 patients had normal or unknown LFTs (0% occult malignancy, 95% CI 0.0–2.5%).

## Discussion

To our knowledge, our study is the largest to specifically investigate the incidence of occult obstructing malignancy in the setting of biliary ductal dilatation incidentally detected and without identifiable cause on contrast-enhanced CT. We found no cases of obstructing malignancy in such patients.

A white paper from the American College of Radiology proposes no further imaging evaluation of incidental biliary ductal dilatation in the setting of normal LFTs [2]. Our findings support this recommendation. Specifically, our findings suggest this approach applies to the case of incidental asymptomatic biliary ductal dilatation without identifiable cause on contrast-enhanced CT. This finding is important, as the increased use of CT imaging has led to a drastic increase

**Table 1** Demographics and length of follow-up for overall cohort, imaging follow-up group, and clinical follow-up-only group

| | Overall ($n=156$) | Imaging follow-up ($n=120$) | Clinical follow-up-only ($n=36$) |
|---|---|---|---|
| Sex | 27 M, 129 F | 16 M, 104 F | 11 M, 25 F |
| Age (mean ± SD, years) | 61 ± 14 | 62 ± 15 | 57 ± 12 |
| Prior cholecystectomy | 87/156 (56%) | 64/120 (53%) | 23/36 (64%) |
| Elevated LFTs | 36/131 (27%) | 30/102 (29%) | 6/29 (21%) |

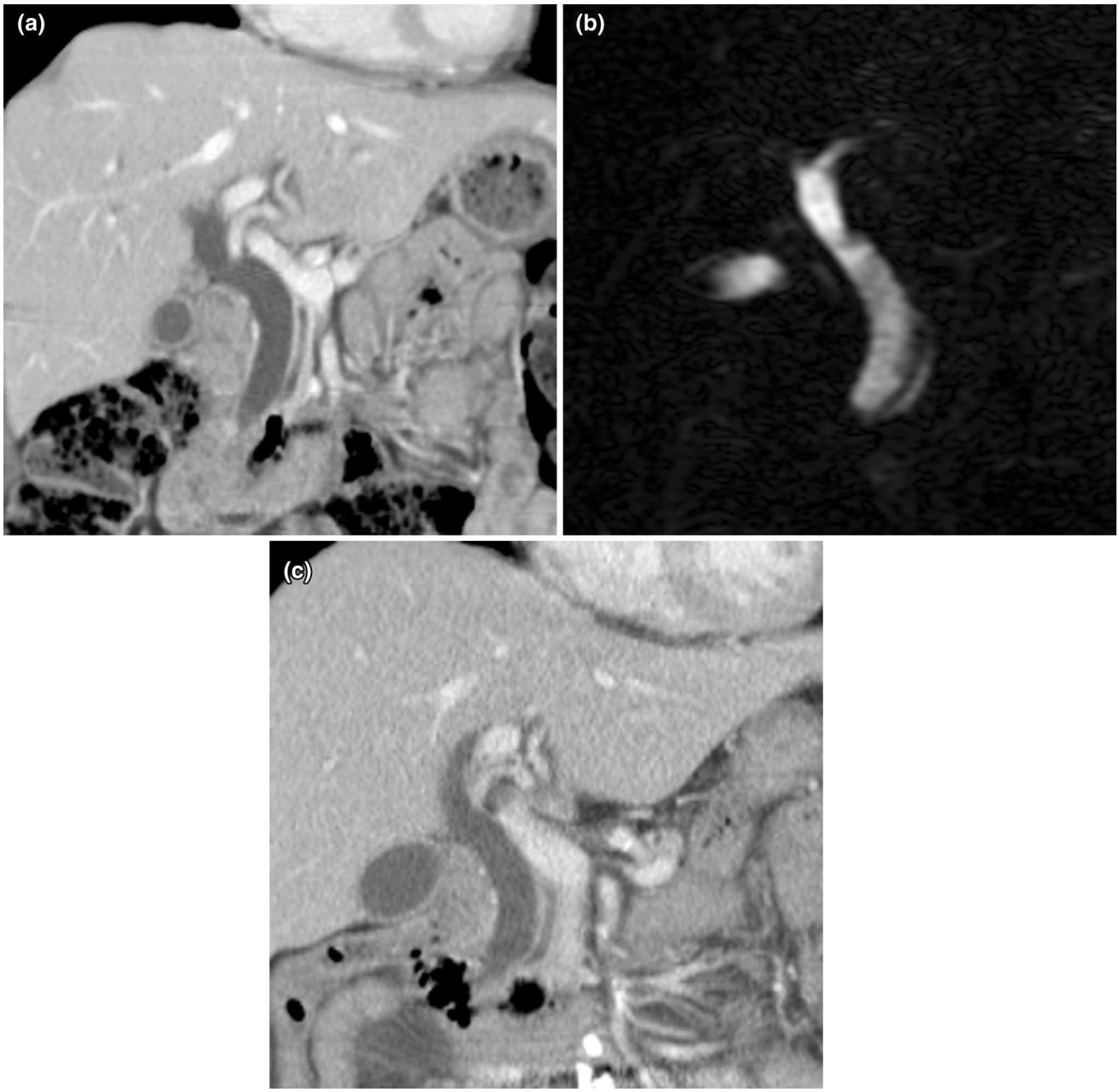


**Fig. 1** A 70-year-old female with incidental intrahepatic and extrahepatic biliary ductal dilatation. **a** Coronal image from index contrast-enhanced CT shows intra- and extra-hepatic biliary dilatation without identifiable source. Follow-up coronal T2-weighted MRCP image 0.6 years later (**b**) and coronal image from contrast-enhanced CT 3.5 years later (**c**) show unchanged biliary dilatation without identifiable source

in incidental findings unrelated to the original clinical indication [8], leading to costly work-ups that potentially expose the patient to additional radiation and psychological stress.

Several prior studies in the gastroenterology literature have noted a 1.8–5% rate of malignancy in patients undergoing EUS for biliary ductal dilatation [3, 9, 10]. Similar findings have been reported for those undergoing MRCP [11]. Differences between these prior studies and our findings may be explained by our strict exclusion criteria. We purposely excluded those with any clinical concern for or symptomatology of an obstructive biliary process, as these are not incidental cases. We also excluded those with isolated intrahepatic duct or concurrent pancreatic duct dilatation, as we hypothesize these patients have higher rates of obstructing malignancy. In addition, these prior studies were specifically examining patients referred for MRCP or EUS evaluation; our rate of MRI, ERCP, or EUS evaluation within 1 year of the index CT was low (21/156, 13%), suggesting our cases

were truly incidental and of low clinical concern. Finally, several of these studies included cases of biliary ductal dilatation referred after diagnosis on transabdominal ultrasound [3, 9, 11]. While transabdominal ultrasound is a useful tool for evaluation of the biliary tree, it is often limited in its assessment for obstructing malignancy; this is particularly true when the distal common bile duct and pancreatic head are obscured by bowel gas.

While our study had no cases of occult malignancy as the source of biliary ductal dilatation, one case did demonstrate an ampullary adenoma on ERCP. Though not a malignant lesion, ampullary adenomas do have premalignant potential. Autopsy studies have demonstrated a prevalence of 0.04–0.12% [12, 13], and these lesions have been increasingly identified due to the growing prevalence and technical advancement of endoscopy. The management of such lesions is evolving, with a trend towards endoscopic ampullectomy [14]. However, there is a low rate of histologic progression, and endoscopic surveillance may be appropriate [15, 16]. The majority of patients present with biliary or pancreatic symptomatology, with 50–75% presenting with jaundice [17]. In our case, the clinical significance of a small asymptomatic ampullary adenoma in the setting of normal LFTs is unclear.

We also had three cases where choledocholithiasis was found after the index CT. This is not surprising as the sensitivity of CT for choledocholithiasis is reportedly between 72 and 88% [18]. However, in all three cases, the patients became symptomatic after the index CT and one patient had a negative MRI between the index CT and diagnosis of choledocholithiasis. This suggests that these patients developed choledocholithiasis after the index CT. It should still be noted that other non-malignant causes of biliary obstruction such as sphincter of Oddi dysfunction could be present in our patient cohort. However, the clinical significance of such findings is uncertain in asymptomatic patients.

Our study does have limitations. First, we only have ERCP/EUS correlation for 13 patients, considered the gold standard in the assessment for biliary obstruction. However, imaging stability for greater than 1 year argues against an aggressive malignancy as the source of biliary ductal dilatation. Similarly, 36 patients had only clinical follow-up. The status of the biliary ductal dilatation is unknown in these patients, but the lack of clinical evidence of malignancy for 2 years argues against a malignant source of biliary obstruction. A total of 155 patients did not meet imaging or clinical follow-up criteria for inclusion; their outcomes are unknown. Our findings cannot be extrapolated to those patients with biliary symptomatology, isolated intrahepatic ductal dilatation, or those with concurrent pancreatic ductal dilatation; further studies are needed to assess these populations. The majority of patients in our study had normal LFTs, and our results may not apply to patients with elevated LFTs.

In conclusions, asymptomatic biliary ductal dilatation incidentally detected and without identifiable cause on contrast-enhanced CT is likely benign in the setting of normal LFTs, and further workup may not be warranted.

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