

Ectopic opening of common bile duct into the duodenal bulb: magnetic resonance cholangiopancreatography findings

Ayşe Erden 
Diğdem Kuru Öz 
İlhan Erden 

PURPOSE

We aimed to evaluate the spectrum of magnetic resonance cholangiopancreatography (MRCP) findings in patients with ectopic opening of the common bile duct (CBD) into the duodenal bulb and to determine the effectiveness of the MRCP technique in diagnosis.

METHODS

Morphologic and morphometric MRCP/MRI features in 16 patients and 36 controls were retrospectively analyzed by 2 radiologists. The frequency of MRCP findings was determined. The significance of the difference between the MRCP observations in patients and controls was evaluated statistically and the diagnostic effectiveness of MRCP was investigated.

RESULTS

Hook-shaped ending of CBD and bulbar deformity were the most frequent morphologic findings seen on MRCP in the ectopic bulbar opening. Mean pylorus-papilla distance and mean CBD length were significantly shorter and the median diameter of CBD was significantly larger than the control group (patients: 28.6 ± 15.3 mm, 33.7 ± 12.8 mm, 8.6 (2-16) mm; controls: 66.7 ± 11.7 mm, 50.3 ± 14.4 mm, 3.2 (1.5-10) mm, $P < .001$, respectively). Receiver operating curve analysis showed sensitivity and specificity of MRCP in the diagnosis to be 87.5% and 100%, respectively, if any 3 of the 4 signs (hook-shaped ending of CBD, bulbar deformity, large, and short CBD) were present in a patient whose pylorus-papilla distance was <50 mm.

CONCLUSION

At MRCP, the presence of short and large CBD with a hook-shaped ending in the deformed duodenal bulb may support the diagnosis of ectopic biliary drainage.

The major papilla is found on the posteromedial surface of the mid-descending duodenum in 87% of subjects.¹ This level is about 7-8 cm distal to the pylorus.^{1,2} In the remaining cases, the drainage of the biliary and pancreatic ducts is ectopic, either into a different part of the duodenum^{1,3} or into the stomach.^{4,5}

The anomalous drainage of the common bile duct (CBD) into the duodenal bulb is an extremely rare condition (Table 1).⁵⁻¹⁰ Apart from the few comprehensive studies,^{7,8} its clinical significance and endoscopic retrograde cholangiopancreatography (ERCP) findings have been reported in a small number of cases or in case series.^{4,6,10-18}

The ectopic opening of CBD in the bulb is slit-shaped and allows for bi-directional interaction of luminal content. The presence of duodenobiliopancreatic reflux predisposes to the development of cholangitis, pneumobilia, hepatolithiasis, choledocholithiasis, gallbladder stone, and pancreatitis.^{6-10,12,16,17} Since there is no sphincter mechanism, uncontrolled bile flow into the bulb causes ulceration. This usually leads to stenosis in the bulb apex requiring gastrojejunostomy in most cases.^{6-10,12,13,19} The data show that many patients with ectopic drainage into the duodenal bulb are undetected until adulthood. As with any undiagnosed or misdiagnosed entity, the quality of life can worsen in this condition due to lack of treatment. Therefore, unlike the other ectopic drainage sites in the duodenum, choledochal drainage into the bulb is more likely to be a clinically relevant entity rather than an incidental finding.^{7,8,12,20}

From the Department of Radiology (D.K.Ö.
digdem_k@hotmail.com), Ankara University School
of Medicine, Ankara, Turkey.

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Table 1. Frequency of ectopic opening of common bile duct into duodenal bulb in ERCP studies

Author and year	Patients (n)	Male/female	Patient age, year	Study design	% anomaly
Lee HJ et al. 1997	8/5180	7/1	54 (mean)	Retrospective	0.15
Lee SS et al. 2003	18/16541	15/3	51 (median)	Retrospective	0.11
Dişibeyaz et al. 2007	53/12158	49/4	55 (median)	Retrospective	0.43
Sarıtaş et al. 2010	7/400	NS ^a	47.5 (mean)	Retrospective	1.75
Sezgin et al. 2010	4/1040	NS ^b	59.2 (median)	Retrospective	0.38
Taş et al. 2018	20/3270	15/5	59 (median)	Retrospective	0.61

^aNot specified in the study. Frequency of overall ectopic biliary drainage is 2% (10 cases, 1 female, 9 male, out of 400 ERCPs). The site of ectopic biliary drainage was duodenal bulb in 7 cases. ^bNot specified in the study. A total of 11 patients out of 1040 (6 men and 5 women with a median age of 59.2 years) received a diagnosis of an ectopic opening of the CBD. The opening site of the CBD was in the duodenal bulb in 4 patients.

Academic publications suggest that the ectopic bulbar opening of the CBD is not well recognized by radiologists. In the literature, there is limited data on the radiologic findings of this entity. The gastroenterologists in the institutions, where a large number of ERCP examinations are performed, are much more familiar with this condition. In published studies which are usually ERCP-based,^{5,10,14,18,19} the diagnostic role of magnetic resonance cholangiopancreatography (MRCP) is not specifically addressed in detail. Thus, we aimed to retrospectively evaluate the MRCP findings and determine the diagnostic effectiveness of the MRCP technique in patients with the ectopic opening of CBD into the duodenal bulb.

Methods

Study population

The institutional review board approved this retrospective observational study (approval number: 01-28-2019) and waived the need for informed consent. The Radiology Information System/Picture Archiving and Communication System (PACS); Centricity 5.0 RIS-i, GE Healthcare

of our institution was searched to identify patients with an abnormal biliary opening. The study population was recruited from the 3428 subjects investigated with MRCP for various clinical indications in our magnetic resonance imaging (MRI) section between August 2011 and December 2018. The inclusion criterion used for the patient group was the presence of direct biliary drainage into the duodenal bulb without any evidence of opening into normal major papilla at MRCP. The exclusion criterion was the presence of postbulbar ulcer (located on the medial wall of the proximal descending duodenum) retracting the major papilla to a more proximal location due to scarring (n=7). The latter was diagnosed with a combination of upper gastrointestinal barium studies, MRCP, and endoscopic examinations. The consecutive patients with normal MRCP who had been investigated at the same interval formed the control group. These subjects were referred for a variety of clinical indications, the most frequent one being the abnormal liver function tests. They were identified from the PACS with the search of the keyword "Normal MRCP." In the follow-up period, none of the controls had a clinical outcome that suggests biliopancreatic disease.

After the initial determination of a patient's eligibility for the study, 1 investigator reviewed the institutional electronic medical records (radiology, pathology, upper gastrointestinal (UGI) endoscopy, pertinent medical history, and discharge summary) of each patient to document demographic and clinical characteristics. For each case and control, the following data were collected: age at MRCP, gender, white blood cell count, C-reactive protein level (mg/L), erythrocyte sedimentation rate (ESR) (mm/h), serum bilirubin level (mg/dL), serum alkaline phosphatase level

(IU/L), and gamma-glutamyl transpeptidase level. The interval between biochemical tests and MRCP ranged between 0 and 40 days. All patients had ultrasonographic (US) and multidetector-row helical computed tomographic (CT) imaging. CT images were not used in the measurement of imaging findings but were evaluated for the presence of pneumobilia. The diagnosis of the abnormal biliary opening was based on findings at endoscopy (n=8), surgery (n=5), or ERCP (n=3). In all patients, CBD was hook-shaped and tapered at the distal part that opens to the bulb on ERCP.

MRI technique

The patients were asked to abstain from solid foods for 6 h before MRCP. Imaging was performed with a 1.5 T MRI unit in the supine position (GE Optima 450w) using a 12-channel body coil. All pulse sequence parameters used in this study are listed in Table 2.

Image analysis

For morphologic evaluation, the secondary findings suggestive of this entity defined in ERCP literature were adapted to MRCP. All MRCP/MRI images were retrospectively and independently analyzed by 2 experienced radiologists with 21 and 5 years of experience in abdominal MRI according to criteria that were defined and tabulated before the reviews. The reviewers were blinded to all clinical information. If the radiologists' interpretations differed significantly, consensus findings were used for the final decision.

Both radiologists evaluated the presence of the following MRCP findings: (a) hook-shaped configuration of the distal end of the CBD (sharply turning of the distal end of the CBD to the right toward the bulb of the duodenum), (b) stricture at the distal end of the CBD, (c) bulbar deformity/apical stenosis (luminal narrowing of the bulb apex caused by spasm secondary to ulcer or by scarring from a previous ulcer), (d) signs of chronic pancreatitis, (e) fat stranding between the duodenal bulb and pancreatic head (inflammation-induced changes in pancreatoduodenal region which may either be related to adhesions between the bulb and pancreatic head or chronic changes related to prior pancreatitis), (f) biliary dilatation, (g) choledocholithiasis, (h) cholangitis, (i) liver abscess, (j) pneumobilia (luminal filling defects at anterior, non-dependent surface in the biliary tract on T2-weighted

Main points

- The presence of short and large common bile duct (CBD) with a hook-shaped ending in the deformed duodenal bulb on MRCP suggests the diagnosis of ectopic biliary drainage.
- Stricture at the apex of the duodenal bulb, gastrojejunostomy, cholangitis, pneumobilia, and/or biliary stones may support the diagnosis of ectopic biliary drainage.
- MRCP findings may help diagnose the ectopic opening of the common bile duct to the duodenal bulb in patients with apical stenosis that do not allow the passage of the ERCP endoscope.

Table 2. Pulse sequence parameters of MRCP

Sequences	T2W SSFSE	T2W FSE	T2W fat-suppressed FSE ^a	T1W SPGR (dual-echo)	Heavily T2W thick slab	Heavily T2W thin slices ^b	Heavily T2W thin slices ^b
Parameters							
Matrix size	320 × 192	320 × 224	384 × 384	256 × 160	384 × 224	288 × 288	288 × 288
Slice thickness (mm)	7.0	7.0	7.0	7.0	40	2.0	1.6
Interslice gap (mm)	0.5	1.0	1.0	1.0	0.0	0.0	0.0
Repetition time (ms)	632	4000	10999	110	3000	Minimum	Minimum
Echo time (ms)	80	90	92	2 and 4.3	900	Minimum	Minimum
Echo trains per slice	-	-	12	-	-	140	140
Flip angle (degrees)	-	-	160	60	-	-	-
FoV (mm)	420 × 420	420 × 420	420 × 420	420 × 378	300 × 300	340 × 340	320 × 320
Orientation	Coronal	Transverse	Transverse	Transverse	Coronal	Transverse	Coronal
Bandwidth (KHz)	83.33	83.33	83.33	62.50	62.50	83.33	83.33
Respiration control	Trigger	Trigger	Trigger	Breath-hold	Breath-hold	Trigger	Trigger

T2W, T2 weighted; SSFSE, single-shot fast spin echo; FSE, fast spin echo; T1W, T1 weighted; SPGR, spoiled gradient echo; FoV, field of view.

^aParallel imaging with a reduction factor 2 was used for axial T2-weighted fat-suppressed sequence; ^bHeavily T2-weighted thin slices were obtained with 3D MRCP fast recovery fast spin echo (FRFSE) XL sequence.

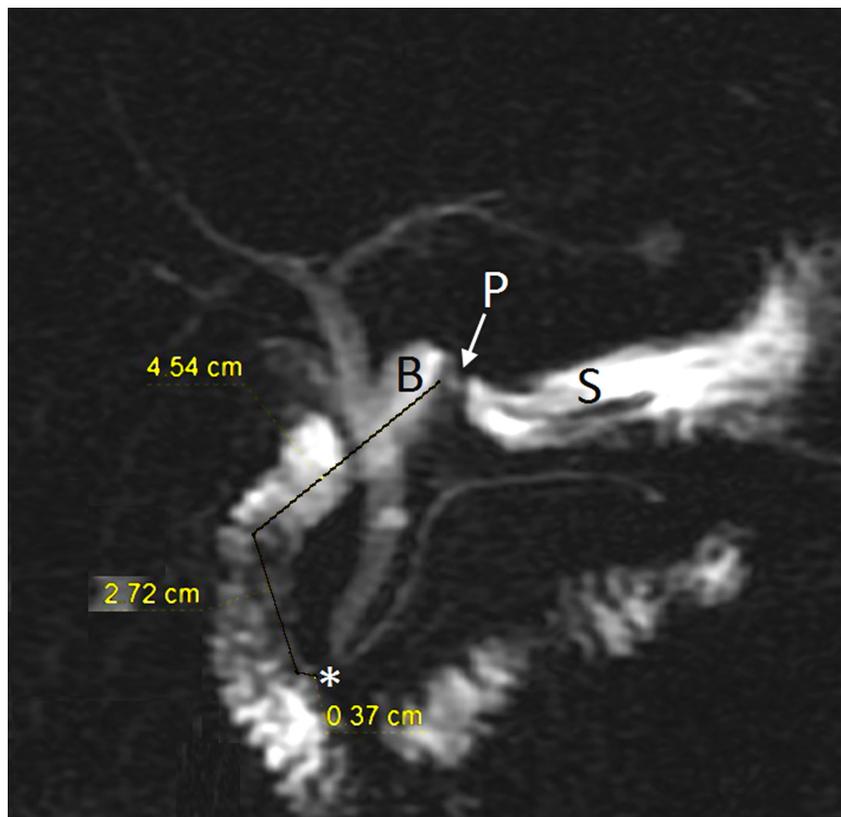


Figure 1. A 46-year-old woman in whom magnetic resonance cholangiopancreatography (MRCP) is requested for a suspected common bile duct (CBD) stone. Coronal heavily T2-weighted thick-slab MRCP shows the measurement of pyloric-papilla distance is normal in this case. The total distance is 7.6 cm. Arrow indicates pylorus (P) and asterisk (*) indicates papilla. B, duodenal bulb; S, stomach.

images and blooming artifact seen on T1-weighted GE in-phase images²¹), (k) hepatolithiasis (intraductal low signal intensity focus at dependent posterior location in intrahepatic ducts at T2-weighted images²¹), (l) cholecystitis, (m) level of the cystic duct insertion to the extrahepatic bile duct (classified as proximal, middle, and distal insertion according to distance between porta hepatis and major papilla⁶), (n) cholecystectomy, (o) gallbladder stone, and (p) gastrojejunostomy. The upper limit of normal diameter was accepted as 7 mm for CBD²²⁻²⁴ as 3 mm for the main pancreatic duct (MPD).²³ Intrahepatic bile ducts were considered as dilated if their diameters measured more than 3 mm.²³

The following quantitative parameters were also determined in each case: (a) pylorus-papilla distance, (b) CBD diameter, (c) MPD diameter, (d) overall length of the extrahepatic bile duct, and (e) length of CBD. Pylorus-papilla distance was defined as the distance between the distal end of the pyloric channel and the ectopic opening site in the duodenal bulb. It was measured either from the oblique coronal heavily T2-weighted thick slabs or from the oblique coronal maximum-intensity-projection reconstructions of heavily T2-weighted thin

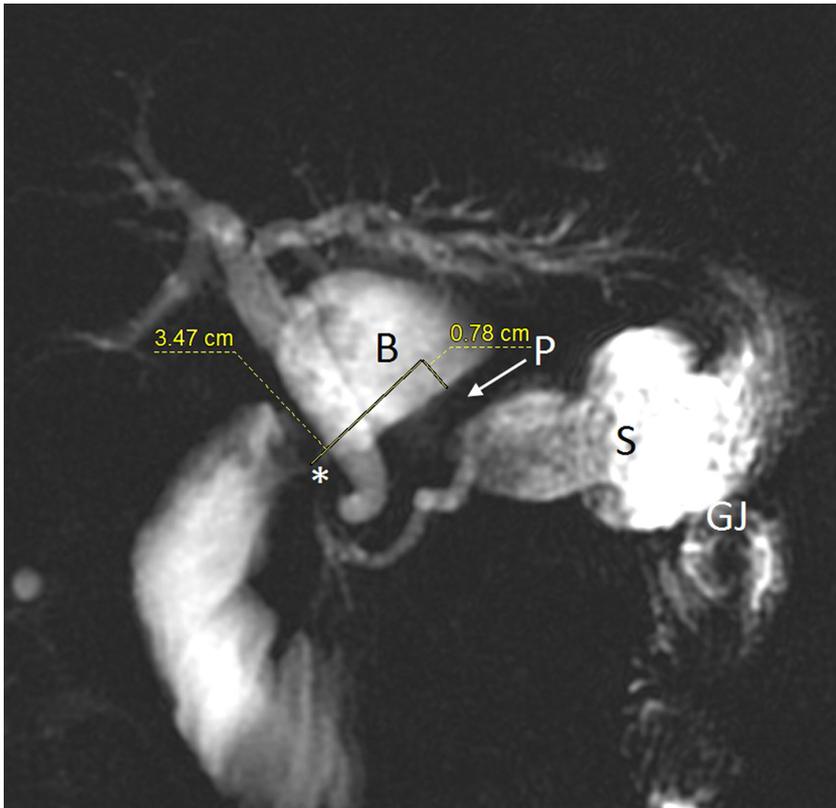


Figure 2. A 56-year-old man had undergone gastrojejunostomy but had persistent dyspeptic complaints. Since the CBD and pancreatic duct are large in ultrasonography, MRCP was requested with suspicion of pancreatic head cancer. Coronal heavily T2-weighted thick-slab MRCP shows dilated CBD (12 mm) which angulated superolaterally. Arrow and asterisk (*) indicate pylorus (P) and papilla, respectively. Pylorus-papilla distance is 4.25 cm in this case with an ectopic opening. B, duodenal bulb; S, stomach.

slices (Figures 1, 2). The duodenal bulb was defined as the first portion of the duodenum which extends from the pylorus to the superior duodenal flexure. The normal length of the bulb was accepted as ≤ 50 mm.²⁵ All

measurements were performed on magnified images to ensure precise delineation of the borders of the evaluated structures. The widest diameter of the CBD and MPD was measured perpendicular to their long axis

Table 3. Comparison of demographic data and laboratory values of patients and controls			
Demographics	Patients, mean \pm SD	Controls, mean \pm SD	P
Age (years) \pm SD	55.7 \pm 10.6	46.1 \pm 14.4	.022*
Male n (%)	10 (62.5)	28 (77.8)	.316
Female n (%)	6 (37.5)	8 (22.2)	
Laboratory tests	Median (min-max)	Median (min-max)	
White blood cell count	7.6 (2.5-25.7)	6.5 (2.5-25.7)	.641
Total bilirubin	0.8 (0.2-5.9)	0.7 (0.3-9.1)	.991
Direct bilirubin	0.2 (0.1-3.6)	0.1 (0.01-6.7)	.125
Alkaline phosphatase (ALP)	93.0 (39.0-598.0)	74.0 (35.0-299.0)	.612
Gamma-glutamyl transpeptidase (GGT)	48.0 (10.0-662.0)	29.0 (9.0-265.0)	.397
C-reactive protein (CRP)	2.0 (0.2-152.3)	3.1 (0.1-76.2)	.294
Erythrocyte sedimentation rate (ESR)	18.0 (10.0-103.0)	8.5 (1.0-44.0)	.006*

*Statistically significant results. SD, standard deviation.

using an electronic caliper. These analyses were performed in an attempt to determine whether the site of anomalous entrance of the CBD had any influence on the length, configuration, or overall shape of extrahepatic bile ducts. The above-mentioned measurements of the patients with biliary opening anomaly were compared with those of the control group.

Statistical analysis

Data were analyzed by Statistical Package for the Social Sciences software for Windows 11.5 (SPSS Inc.). The averages of the measurements of both observers were used for statistics. Descriptive statistics were shown as mean \pm standard deviation for variables with normal distribution and median (minimum-maximum) for variables with non-normal distribution. Nominal variables were shown as the number of subjects (n) and percentages (%).

The significance of the difference between the observations in patients and the controls was investigated by independent samples T-test and Mann-Whitney U test. Between 2 groups nominal variables were evaluated by Pearson chi-square and Fisher exact test. Results were defined as statistically significant when the respective test statistic had a P value less than .05.

Receiver operating characteristic (ROC) analysis was performed to distinguish between patients with the ectopic opening of CBD and subjects with normal biliopancreatic ducts in terms of pylorus-papilla distance. To reveal the ectopic opening of the CBD, a scoring system based on MRCP findings, where the presence of each finding is scored as 1, was constituted. The following MRCP findings were scored: (a) hook-shaped ending of CBD, (b) bulbar deformity, (c) CBD dilatation, and (d) presence of short CBD. The upper limits of normal diameter and normal length of CBD were accepted as 7 mm^{23,24} and 47 mm,²⁵ respectively. The maximum score was 4 in the presence of all findings. The ROC analysis was performed to determine the diagnostic effectiveness of the MRCP score. Youden's index was used in the ROC analysis for cutoff values.

Results

Sixteen patients with ectopic bulbar opening and 36 controls with normal MRCP were included in the study. The demographics of both groups were outlined in

Table 4. Frequency and percentages of symptoms, medical histories/previous surgeries and MRCP findings in patients with ectopic drainage of CBD into duodenal bulb

Parameter	Patients, n (%)
Symptoms	
Episodic upper abdominal pain	7 (43.7)
Dyspeptic complaints	4 (25.0)
Jaundice + episodic biliary pain	2 (12.5)
Jaundice	1 (6.2)
Jaundice + fever	1 (6.2)
Melena	1 (6.2)
Past medical history	
Recurrent duodenal ulcer	6 (37.5)
Recurrent cholangitis	4 (25.0)
Recurrent duodenal ulcer + recurrent cholangitis	4 (25.0)
Recurrent bleeding duodenal ulcer	2 (12.5)
Gastrojejunostomy + cholecystectomy	4 (25.0)
Cholecystectomy	2 (12.5)
Gastrojejunostomy	1 (6.2)
MRCP findings	
Hook-shaped ending of CBD	14 (87.5)
Bulbar deformity/apical stenosis	14 (87.5)
MPD abnormality	5 (31.2)
Obliteration of fat plane between bulb and pancreas	6 (37.5)
Chronic pancreatitis	3 (18.8)
Gall bladder stone	2 (12.5)
CBD stone	4 (25.0)
Cholangitis	11 (68.8)
Pneumobilia	8 (50)
Hepatalithiasis	1 (6.2)
Gastrojejunostomy	5 (31.3)
Cholecystectomy	6 (37.5)
IHBD dilatation	14 (87.5)
EHBD dilatation	12 (75)
CBD stricture	2 (12.4)
Liver abscess	1 (6.2)

CBD, common bile duct; MPD, main pancreatic duct; IHBD, intrahepatic bile duct; EHBD, extrahepatic bile duct.

Table 3. The ectopic opening of the CBD into the duodenal bulb was detected in 16 cases (0.47% of the total). The patients and the controls were similar with respect to sex ($P=.316$) but different with respect to age ($P=.022$). The laboratory values of both groups are indicated in Table 3. There was no significant difference between the 2 groups in laboratory values except ESR ($P=.006$). Patients' symptoms and medical histories are summarized in Table 4.

The frequency of MRCP findings in patients with ectopic opening is shown in

Table 4. In 1 patient, the only MRCP finding related to bile ducts was short CBD. The distal end of the CBD had a hook-shaped configuration in 14 patients (87.5%). Stricture at the distal end of the CBD was detected in 2 patients. The CBD was dilated (>7 mm) in 12 patients (75%) and intrahepatic bile ducts were dilated in 14 patients (87.5%). Stones were noted in the CBD in 4 patients (Figure 3), in the gallbladder in 2 patients, and in intrahepatic bile ducts in 1 patient. Cholangitis was detected in 11 and pneumobilia was

detected in 8 patients (Figures 3, 4). The patients presenting with pneumobilia had no prior procedure like sphincterectomy or biliary anastomosis to account for this finding. Bulbar deformity/apical stenosis was present in 14 patients (Figures 3, 4), and out of these patients, 5 had undergone gastrojejunostomy.

The cystic duct insertion site was in the middle third in 12 (75%), distal third in 3 (18.8%), and proximal third of the extrahepatic bile duct in 1 patient (6.3%). Among the control subjects, the cystic duct insertion was in the proximal third of the extrahepatic duct in 18 (50%), in the middle third in 16 (44.4%), and in the distal third in 2 (5.6 %). Cystic duct insertion was significantly different between the 2 groups ($P=.004$).

The MPD was visualized in all patients. Clinical signs of chronic pancreatitis were found in 2 of the 5 patients (12.5%) with abnormal MPD. One patient (6.2%) with normal MPD had also a clinical diagnosis of chronic pancreatitis.

On T2-weighted images, there was fat stranding between the duodenal bulb and the pancreatic head in 7 patients (43.8%). In the control group, the effacement of the fat plane between the duodenal bulb and the pancreatic head was detected in only 1 patient (2.8%). The difference was statistically significant ($P < .001$).

In the ROC analysis, the pylorus-papilla distance was found to be significantly shorter ($P < .001$) in patients (Figures 1, 2), and the area under the curve (standard error) was 0.96 (0.035). For the 51.5 mm threshold value, the sensitivity and the specificity were 93.8% (95% CI, 0.71-0.98) and 94.4% (95% CI, 0.81-0.98), respectively, for the detection of bulbar opening.

Morphometric parameters and significance of measurement differences of both groups are shown in Table 5. In 15 of 16 patients (93.7%), the pylorus-papilla distance was <50 mm. The mean distance was significantly shorter in patients (Figure 2) with the ectopic opening ($P < .001$).

In the patient group, the mean lengths of the CBD and extrahepatic bile duct (EHBD) were 33.7 ± 12.8 mm and 61.2 ± 11.9 mm, respectively. These lengths were 50.3 ± 14.4 mm and 74.7 ± 12.1 mm, respectively, in controls. There was a statistically significant difference between the 2 groups in terms of CBD and EHBD lengths ($P < .001$ and $P=.001$, respectively). The

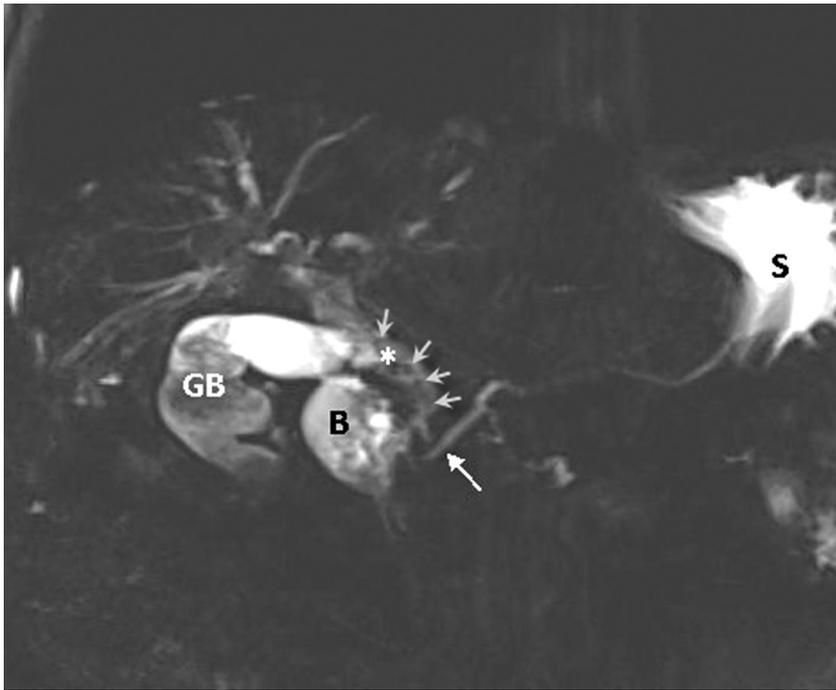


Figure 3. A 72-year-old man with episodic abdominal pain and fever. Coronal heavily T2-weighted thick-slab MRCP shows dilated CBD (*asterisk*) which opens into duodenal bulb. Note filling defects (*small arrows*) in CBD due to stones and air. Intrahepatic biliary dilatation, pneumobilia, and sludge/sludges in gallbladder and CBD are associated with the ectopic opening anomaly. *Arrow* indicates main pancreatic duct (MPD). The patient had also gastrojejunostomy (not shown) due to apical stricture. B, duodenal bulb; GB, gall bladder.

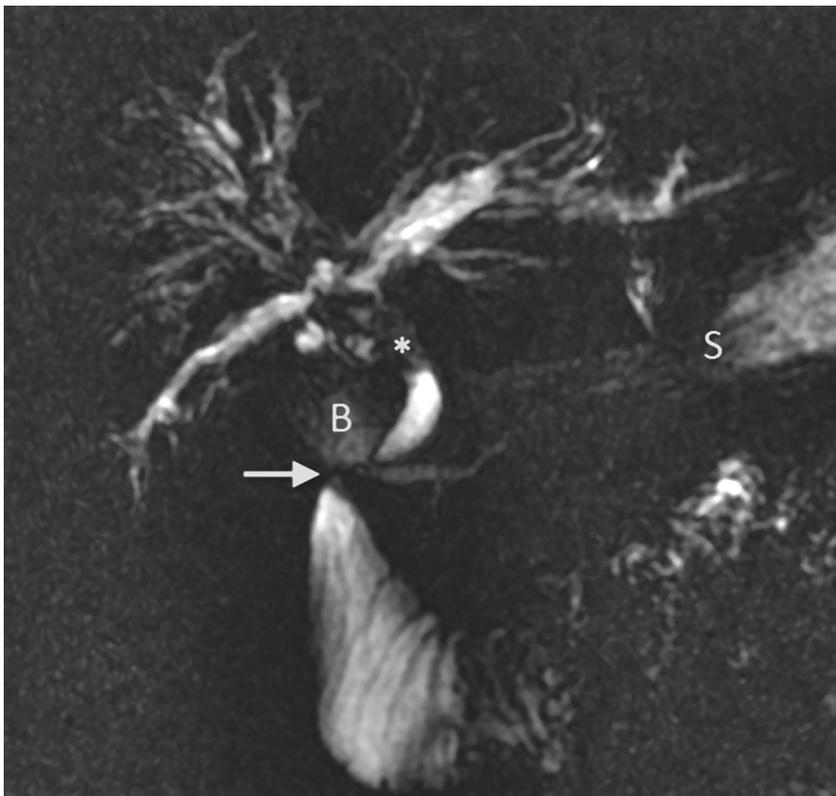


Figure 4. A 48-year-old man with abdominal pain, pruritis, and jaundice. Coronal heavily T2-weighted thick-slab MRCP shows dilatation in intrahepatic bile ducts. Note turning of the distal end of the CBD to the right toward the bulb of the duodenum. Proximal extrahepatic bile duct is not visualized because of pneumobilia (*asterisk*). Note narrowing of apical portion of the duodenal bulb (*arrow*) that causes bulbar deformity. B, duodenal bulb; S, stomach.

median (minimum-maximum) diameter of CBD was significantly larger in patients than that in the control group ($P < .001$).

The MPD was dilated in 5 of the 16 (31.2%) patients. The MPD diameter was significantly larger in the patient group ($P = .005$) (Table 5).

ROC analysis showed the effectiveness of the scoring system in differentiating patients and controls. The area under the ROC curve (standard error) was 1.00 (0.0) and was considered statistically significant ($P < .001$) in diagnosing ectopic opening of CBD with MRCP findings. The threshold value of 2.5 score showed 87.5% sensitivity (95% CI, 0.64-0.96) and 100% (95% CI, 0.90-1.00) specificity in revealing the presence of ectopic CBD opening. In other words, if any 3 of the 4 signs (hook-shaped ending of CBD, bulbar deformity, large CBD, and/or short CBD) were present in a patient with the pylorus-papilla distance ≤ 50 mm, the sensitivity of the MRCP was 87.5% and the specificity was 100% in the diagnosis of the ectopic opening of CBD into the duodenal bulb.

Discussion

In this single-center retrospective analysis, 16 of 3428 patients (0.47%) evaluated by MRCP over a period of 7.5 years were identified to have an ectopic opening of CBD in the duodenal bulb. This is concordant with the ERCP studies (Table 1). However, it is impossible to give a conclusion about the prevalence of this anomaly in the population, both because of asymptomatic cases and because there may be cases that are symptomatic but undiagnosed.^{7,8} This entity has different characteristics from the other bilioenteric opening anomalies due to its specific location and seems to be out of the commonly experienced range which is considered as "normal variation."

Although the ectopic opening of the CBD in the duodenal bulb is assumed to be congenital in nature,²⁶ the "typical" patient admitted with symptoms is a middle-aged man.^{5,8,9} This shows that some of the patients are asymptomatic for a long period. Nonspecific complaints occur in most of the clinically apparent cases, with upper abdominal pain being the most frequent symptom during admission.⁸ Laboratory data are of minimal clinical value in diagnosis compared with clinical awareness and good-interpreted ERCP or MRCP study.⁵⁻⁹

Table 5. Comparison of morphometric parameters in patients and controls

Parameter	Patients (n = 16)	Controls (n = 36)	P
Pylorus–papilla distance (mm), mean ± SD	28.6 ± 15.3	66.7 ± 11.7	<.001
CBD diameter (mm), median (range)	8.6 (2-16)	3.2 (1.5-10)	<.001
MPD diameter (mm), median (range)	2.2 (1-9)	1.5 (0.7-5.3)	.005
CBD length (mm), mean ± SD	33.7 ± 12.8	50.3 ± 14.4	<.001
EHBD length (mm), mean ± SD	61.2 ± 11.9	74.7 ± 12.1	.001

CBD, common bile duct; MPD, main pancreatic duct; EHBD, extrahepatic bile duct.

The ectopic bulbar opening of the CBD can be clinically important for the following reasons. First, the presence of a 2-sided luminal interaction between the duodenum and biliary tract can lead to cholangitis, pneumobilia, hepatolithiasis, choledocholithiasis, or pancreatitis.^{4,6,8,9} Second, bile flow into the duodenal bulb without sphincteric control causes duodenal ulcer formation and ulcer complications. In the study reported by Parlak et al.¹⁹ when the patients with apical bulbar stenosis were evaluated prospectively, the incidence of the ectopic papilla in the duodenal bulb was 100% which means all patients with this anomaly have apical stenosis or deformity.¹⁹ Third reason why this anomaly is important is that the EHBD is at risk of damage during the operations related to this area.^{4,6,20}

The MRCP findings of our study support the data of previous ERCP studies in the literature.⁵⁻¹⁰ However, unlike the studies conducted with ERCP, we were able to take advantage of some of the technical benefits of MRCP. This method offered us direct visualization of the drainage site of the CBD. Another advantage of MRCP was that the MPD could be visualized in all cases. According to the literature, cannulation and opacification of the MPD during ERCP is possible in only 13%-22% of the patients with ectopic bulbar opening.^{6,8} The reflux of the duodenal content (food debris) from the incompetent opening into the MPD and occasional blockage of the duct may be the reason why the MPD is not visualized in most of the ERCP studies. The MPD dilatation is found in 33% of patients who have an available pancreatogram at ERCP.⁸ This rate is comparable to what we observed (31%).

Another issue related to this condition is that stenosis next to the bulb apex can be an important risk factor for duodenal perforation during ERCP. Passing distally through the stricture can be difficult and unsafe in inexperienced hands.^{5,8} In such cases, when ERCP cannot be accomplished,

MRCP can show the distal part of the apical stricture and the descending duodenum. If combined with standard sequences, another favorable property of MRCP is that it allows imaging of organs adjacent to CBD. Besides that, MRCP can show associated findings of ectopic biliary drainage such as cholangitis, pancreatitis, and gastrojejunostomy and prevents patients from undergoing unnecessary invasive diagnostic procedures.

Our study has limitations. These include its single-center design, small sample size, reliance on retrospective medical chart review for evaluation of the patient data, and lack of ERCP for verification of the ectopic papilla in several patients. However, studies conducted with ERCP have shown that an ectopic orifice of the CBD in the duodenal bulb may be missed at endoscopy because of bulbar deformity and the small size of the biliary orifice. In cases with apical stenosis, the duodenal lumen diameter may not allow passage of the endoscope, and the major papilla may not be seen.⁵ The risk of ERCP-related complications²⁷ can limit the forward step during the procedure. Thus, if the endoscopist has turned his/her attention to the findings that are found to explain the patients' clinical symptoms (such as bulb deformity, apical stenosis), he/she may be negligent in taking a risk and confirming ectopic opening.

In conclusion, MRCP can show many of the characteristic changes that are associated with the ectopic bulbar opening of the CBD. If the CBD is larger and shorter than normal and has a hook-shaped appearance on its way to the duodenal bulb, it should prompt the radiologist to determine if there are other clues related to this condition such as stricture in duodenal bulb apex, gastrojejunostomy, cholangitis, pneumobilia, and/or biliary stones. It is important to look for these associated findings at MRI/MRCP in suspected cases.

Conflict of interest disclosure

The authors declared no conflicts of interest.

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