The Clinical Significance of Common Bile-Duct Dilatation in Patients without Biliary Symptoms or Causative Lesions on Ultrasonography

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Background and Study Aims: **Although abdominal ultrasonography (US) is a good initial screening method for detection of biliary tract disease, we sometimes encounter patients who only have findings of dilatation of the common bile duct (CBD) on US, without specific biliary symptoms or jaundice. This study aimed to evaluate the causes and clinical significance of dilatation of the CBD in patients without biliary symptoms, jaundice, or causative lesions at US.**

Patients and Methods: **A total of 77 patients who had no biliary symptoms and whose internal CBD diameter was more than 7 mm, without definite causative lesions on US, were enrolled. Of these, 49 underwent endoscopic retrograde cholangiopancreatography (ERCP) and 28 underwent follow-up US or computed tomography (CT) instead of ERCP. We excluded patients whose bilirubin level had increased beyond the upper normal level or who had previous history of upper abdominal surgery including cholecystectomy.**

Results: **The ERCP findings were as follows: no lesion in 20 patients (40.8 %), juxtapapillary duodenal diverticulum (JDD) in 11 (22.5 %), benign stricture in ten (20.4 %), distal CBD mass in two (4.1 %), choledochal cyst in two (4.1 %), anomalous union of the pancreaticobiliary duct (AUPBD) in two (4.1 %), and choledochal cyst with AUPBD in two (4.1 %). There were no differences in age or in alkaline phosphatase or gamma-glutamyl transpeptidase (GGT) levels between the patients who had causative lesions revealed at ERCP and those who did not. Among the 28 patients who did not undergo ERCP, 12 had returned to normal and eight had no change in CBD diameter on follow-up US. Among eight patients who underwent CT, there were four with normal findings, one with JDD, and three with suspected choledochal cysts.**

Conclusions: **We detected a significant number of causative biliary tract lesions in asymptomatic adults with dilatation of the CBD on routine abdominal US; no laboratory or demographic parameters were useful for discrimination. Further diagnostic study will be helpful for the early diagnosis of biliary tract disease in such patients.**

Introduction

Abdominal ultrasonography (US) is a good initial screening method to detect biliary tract diseases, and a dilated biliary tree signifies biliary obstruction. Patients who show a dilatation of the common bile duct (CBD) on US with obstructive lesions or biliary symptoms such as biliary pain, jaundice, fever, or significant cholestatic laboratory findings, should be evaluated further to find out the cause of obstruction. However, we sometimes encounter non-jaundiced patients who only have US findings of dilatation of the CBD without specific biliary symptoms and have normal or mildly abnormal laboratory findings. Because the sensitivity of US is much lower in the detection of distal CBD lesions in a non-jaundiced patient than in a jaundiced one [1], some pathologic lesions might be missed by US only in these patients. However, there have been no studies of the clinical significance of CBD dilatation and diagnostic guidelines in this situation.

Therefore we prospectively evaluated the causes and clinical significance of dilatation of the CBD in patients without biliary symptoms or causative lesions on US and clarified the necessity for other diagnostic modalities to discover the pathologic conditions.

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Patients and Methods

Between January 1995 and October 1999, we evaluated individuals who were referred to the gastroenterology clinic of Samsung Medical Center from health promotion centers or nearby hospitals because of dilated CBD on US without definite causative lesions, and who fulfilled the following criteria: a) internal diameter of CBD more than 7 mm on US; b) no clinical symptoms of biliary obstruction such as biliary pain, jaundice, or fever; c) no previous history of pancreatitis, jaundice, or biliary pain; d) normal serum total bilirubin level (normal 0.2–1.2 mg/dl); e) no previous history of abdominal surgery including cholecystectomy and gastrectomy.

In 106 patients who met the inclusion criteria, 49 (23 men, 26 women; median age 54, range 29–72) underwent endoscopic retrograde cholangiopancreatography (ERCP). A total of 28 patients (ten men, 18 women; median age 58, range 40–75) underwent follow-up US or computed tomography (CT) instead of ERCP, and 29 (12 men, 17 women, median age 61, range 52–78) were lost during follow-up without any further examination. We analyzed laboratory findings and US, CT, and ERCP findings. Gray-scale US examinations were performed using a 2–5-MHz convex-array transducer (HDI 5000; Advanced Technology Laboratories, Bothell, Washington, United States) and ERCP procedures were carried out using the Olympus duodenoscopes (JF-200 or TJF-200, Olympus Optical Co., Tokyo, Japan).

The individuals included were grouped according to the presence or otherwise of causative lesions on ERCP. Then, their sex, age, CBD diameters on US, and laboratory findings such as alkaline phosphatase (ALP) and gamma-glutamyl transpeptidase (GGT) were compared.

Statistics

The results are presented as mean and standard deviation. The differences of factors between the groups were assessed using Student's *t*-test and the chi-squared test. The parameters were also compared using multivariate analysis and logistic regression. A *P*-value of less than 0.05 was regarded as statistically significant.

Results

The ERCP findings in patients included are showed in Table **1**. Of the 49 individuals, 20 (40.8%) showed no abnormal lesions on ERCP, and 11 (22.5%) had juxtapapillary duodenal diverticulum (JDD). Among them, two patients showed definite indentation of the CBD by the diverticulum, which could be regarded as a lesion directly causing CBD dilatation. Benign strictures were suspected in ten patients (20.4%) on ERCP. In two patients with benign strictures it was not possible to rule out malignancy on ERCP and CT, so the diagnosis was made by operation.

In eight out of 49 patients (16.3%), clinically significant lesions were identified. These consisted of one distal CBD cancer, one distal tubular adenoma, two choledochal cysts, two anomalous unions of the pancreaticobiliary duct (AUPBD), and two choledochal cysts with AUPBD. The clinical characteristics of these patients are described in Table **2**.

Table 1 Endoscopic retrograde cholangiopancreatography (ERCP) findings in patients included in the study

Finding	n (%)
No lesion	20 (40.8)
JDD without CBD indentation	9 (18.4)
JDD with CBD indentation	2 (4.1)
Benign stricture	10 (20.4)
Distal CBD mass	2 (4.1)
Choledochal cyst	2 (4.1)
AUPBD	2 (4.1)
Choledochal cyst with AUPBD	2 (4.1)

JDD: juxtapapillary duodenal diverticulum; CBD: common bile duct; AUPBD: anomalous union of the pancreaticobiliary duct.

Table 2 Clinical characteristics of the patients with significant causative lesions

Patient No.	Sex/age, y	Diameter of CBD on US, mm	Cause of CBD dilatation	ALP*, IU/l	GGT†, mg/dl
1	M/59	12.0	Distal CBD adenoma	83	63
2	M/65	14.0	Distal CBD cancer	88	22
3	F/42	12.0	Choledochal cyst, type I	40	13
4	M/55	10.0	Choledochal cyst, type I	126	24
5	F/29	10.0	AUPBD	79	–
6	M/51	10.0	AUPBD	72	49
7	F/55	15.0	Choledochal cyst type I with AUPBD	57	23
8	F/43	25.8	Choledochal cyst type I with AUPBD	36	11

ALP: alkaline phosphatase; GGT: gamma-glutamyl transpeptidase; CBD: common bile duct; AUPBD: anomalous union of the pancreaticobiliary duct. * Normal 30–115 IU/l, † Normal 8–35 mg/dl.

Table **3** shows the comparison of clinical characteristics between the groups classified according to the presence or otherwise of causative lesions. There were no significant differences in sex, age, ALP, or GGT between the two groups. The CBD diameter showed no correlation with ALP or GGT (Figure **1**). The CBD diameter of the patients with causative lesions (13.2 ± 3.9mm, range: 10–25.8mm) was significantly greater than that of those without (10.7 ± 2.0 mm, range: 7–12.5 mm). ($P = 0.04$) (Figure **2**). In multivariate analysis, there was a significant difference in CBD diameter only between the two groups ($P = 0.032$, odds ratio [OR] = 0.603). A definite CBD diameter showing an optimal positive predictive value could not be obtained, because there was much overlap between the two groups in their CBD diameters. However, the diameter of the CBD on US tended to be greater than 10 mm in patients with causative lesions.

Five patients with JDD received regular US examinations for 18 to 48 months and all of them showed persistent dilatation of the CBD. Most of the patients (16/20) who had causative lesions except those who underwent operations showed persistent dilatation of the CBD for 12 to 60 months.

A total of 28 patients refused ERCP and received follow-up US or CT instead. The length of follow-up was 19.8 months (6–57 months). Because definite causative lesions could not be evaluated using US or CT, we did not include these patients when analyzing sex, age, and laboratory findings.

In 12 patients, the diameter of the CBD became normal in 6 to 15 months during the follow-up period. Eight patients had no change in dilatation of the CBD for 6–36 months. Among eight patients who underwent CT there were four normal CBDs, three suspected choledochal cysts, and one JDD. Three patients with suspected choledochal cysts and the one patient with JDD were lost during follow-up without further diagnostic study because they were elderly (more than 75).

Discussion

In 1979, Parulekar found that the mean diameter of the normal CBD was 4.1 mm and that 4% of normal people had a duct diameter of more than 7 mm [2]. Then, he insisted that a common duct greater than 7 mm in diameter should be considered dilated. Since then, there have been many contradictory results concerning the normal diameters and upper normal limits of the CBD (4–8 mm) [3–5]. Park et al. determined the average diameter of the CBD and the upper limit in 230 healthy Korean people using US. The mean diameter was 4.5 ± 1.8 mm at the proximal CBD. and in 95% of all people the diameter was less than 7.3 mm. They also concluded that a proximal CBD with a diameter found to be larger than 7 mm on sonographic examination should be followed closely and evaluated further with clinical examination [6].

Table 3 Clinical characteristics classified according to the presence of causative lesions. Group I, no causative lesions; group II, causative lesions

	Group I*	Group II†	P value
N	29	20	
M:F	12:17	11:9	n.s.
Age, y	52.9 ± 10.9	56.8 ± 10.5	n.s.
CBD diameter, mm	10.7 ± 2.0	13.2 ± 3.9	< 0.05
ALP (IU/l)	82.6 ± 38.0	90.6 ± 46.6	n.s.
GGT (mg/dl)	45.8 ± 57.5	36.7 ± 23.4	n.s.

CBD: common bile duct; ALP: alkaline phosphatase; GGT: gamma-glutamyl transpeptidase; n.s.: not significant. *No causative lesion of CBD dilatation on endoscopic retrograde cholangiopancreatography (ERCP) (no lesion, juxtapapillary duodenal diverticulum JDD without CBD indentation). †Causative lesion of CBD dilatation on ERCP (JDD with CBD indentation, benign stricture, CBD mass, choledochal cyst, anomalous union of the pancreaticobiliary duct [AUPBD])

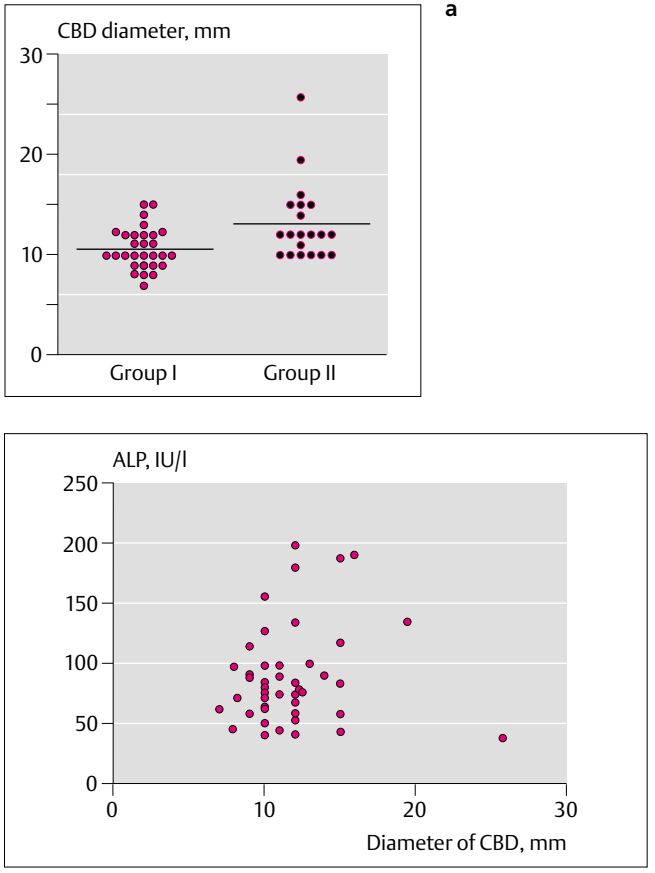

Figure 1 The common bile duct (CBD) diameter showed no correlation with alkaline phoshatase (ALP) or gamma-glutamyl transpeptidase (GGT). **a** ALP (r = 0.125, $P = 0.399$), **b** GGT (r = 0.171, $P = 0.292$)

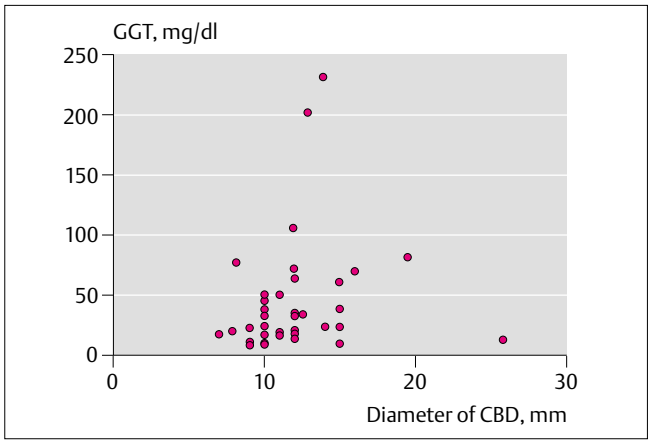

Figure 2 Distribution of common bile-duct (CBD) diameter classified according to the presence of otherwise of causative lesions. Group I, no causative lesion of CBD dilatation on endoscopic retrograde cholangiopancreatography (ERCP). Group II, causative lesion of CBD dilatation on ERCP. Among 20 patients who showed no abnormal lesions on ERCP, 10 patients were followed up every 6 months using US for 18 to 60 months. Five had regained a normal CBD diameter, and in five the CBD remained dilated to more than 7 mm

Figure 3 Cholangiography reveals a definite indentation of the common bile duct (CBD) by juxtapapillary duodenal diverticulum (JDD), which is an important cause of dilatation of the CBD

However, there have been no reports about the causes of CBD dilatation in healthy individuals, and no answers on whether we should carry out further study in those patients.

In our study, 20 out of 49 patients were found to have causative lesions for CBD dilatation, and among them, a significant number of patients (8/49) were found to have pathologic lesions which required specific treatment or close follow-up. We included only the patients in whom ERCP was performed, because ERCP has been up to now the most reliable method for the evaluation of bile-duct lesions. One patient showed transient elevation of amylase and lipase without pain after the ERCP procedure. No other complications developed.

JDD is not a rare condition and usually it does not provoke symptoms by itself. However, in several studies, it has been shown to be associated with an increased frequency of various pathological conditions, such as choledochal stones or pancreatic disorders [7–9]. There was no evidence of biliary stones or pancreatitis in our patients; two patients showed a definite indentation of the CBD by JDD, which could be regarded as the direct cause of CBD dilatation (Figure **3**). Although the remaining patients did not show indentation of CBD, other possible mechanisms such as dysfunction of the sphincter of Oddi, would have accounted for it [10–12].

Mild benign biliary strictures were found in many of our patients (10/49). Nonetheless, they had no history of previous bile-duct surgery, choledocholithiasis, or cholangitis, which are the frequent causes of biliary stricture. We defined the benign stricture as a persistent stenosis of the bile duct with proximal dilatation during ERCP. Functional stenosis such as hypertension of the sphincter of Oddi would be considered in such cases. However, sphincter of Oddi manometry was not performed because the patients had no biliary symptoms.

In two patients in our study, distal CBD masses which were suspected on ERCP (Figure **4**) proved to be an adenocarcinoma and a tubular adenoma after operation. Because the lesions were detected early, before symptoms related to the masses appeared, complete resections were fortunately possible. The patients have been doing well for 36 months and 7 months after operation respectively.

US is considered as the best imaging method of choledochal cysts, which are shown as a characteristic cystic or fusiform dilatation of the extrahepatic or intrahepatic bile ducts [13]. However, recent studies have reported that its diagnostic accuracy is lower than that of CT or ERCP [14, 15]. Type I choledochal cysts, which show up like a diffuse dilatation of the CBD on US, are especially difficult to diagnose as choledochal cysts by US only. The two patients who had type I choledochal cysts with AUPBD received operations (cyst excision and Roux-en-Y hepaticojejunostomy). The remaining two patients with choledochal cysts are being annually observed using US.

AUPBD is a congenital anomaly in which the junction is located outside the duodenal wall. Recently, attention has been focused on the high incidence of malignancy, especially gallbladder cancer, and its possible etiologic role in the formation of a choledochal cyst in this anomaly [16–18]. Identification of dilatation of the CBD by abdominal

Figure 4 On cholangiography, a round filling defect suggesting a mass lesion is seen in the distal common bile duct (CBD). This lesion was revealed to be a tubular adenoma after operation

US is indicative for early detection of AUPBD in asymptomatic individuals. One prospective study [19] also showed a considerable incidence of AUPBD in asymptomatic individuals with CBD dilatation. In that study, the proportion of AUBPD was greater than ours (23 %, 5 out of 22), because patients in whom the CBD diameter was over 10 mm were included.

The necessity of prophylactic cholecystectomy and/or excision of CBD at the diagnosis of AUPBD with or without dilatation of CBD is being advocated [20–22].However, our patients with AUPBD not accompanied by choledochal cyst are being observed closely, because prophylactic cholecystectomy is still controversial.

It has been believed that most individuals with a dilated CBD but no obvious site or cause of mechanical obstruction are elderly. It is postulated that dilatation is due to a combination of age and/or chronic inflammation, which destroys the elastic recoil and contractability of the duct wall. The normal inner diameter of the CBD can be up to 10 mm and there is a mild change of duct size with age [23]. However, there is a report that the mean width of the CBD is 4.1 mm even in patients aged 71 or older [24]. In our patients, there was no significant difference in age between those who had causative lesions and those who did not. Therefore, dilatation of the CBD in aged persons must not be overlooked in the assumption that it is a normal variant. Regardless of age, the CBD diameter of those patients with causative lesions was greater than 10 mm in this study. Although we could not identify an optimal diameter of the CBD which indicates the presence of causative lesions, we believe that further evaluation is necessary for patients with dilatation of the CBD to greater than 10 mm, in order not to miss significant biliary tract lesions.

In our study, several patients were lost during follow-up, in most cases because they were healthy people without gastrointestinal symptoms or abnormal laboratory findings. At follow-up US, most of the patients who had causative lesions on ERCP showed persistent dilatation of the CBD for several years. Therefore, the patients who refused ERCP and had persistent dilated CBD on regular US for several years could be expected to show some causative lesions on further examination.

Nowadays, endoscopic ultrasonography (EUS) and magnetic resonance cholangiopancreatography (MRCP) have become alternative diagnostic procedures to ERCP for the assessment of cholestasis [25, 26]. We used ERCP as our method of choice in determining the cause of bile-duct obstruction in this study because there was no clear consensus regarding optimal technique and no evidence for the cost-effectiveness of these alternative methods at the initial phase of the study. In future, EUS or MRCP may be good noninvasive tools for screening of patients with dilated CBDs, but cost-effectiveness studies should be performed.

In conclusion, there were considerable causative and significant biliary tract lesions in patients without biliary symptoms, or jaundice, but with dilatation of the CBD revealed on routine abdominal US, and laboratory or demographic parameters showed no discrimination value. Therefore further diagnostic study will be helpful for early diagnosis of biliary tract disease in such patients.

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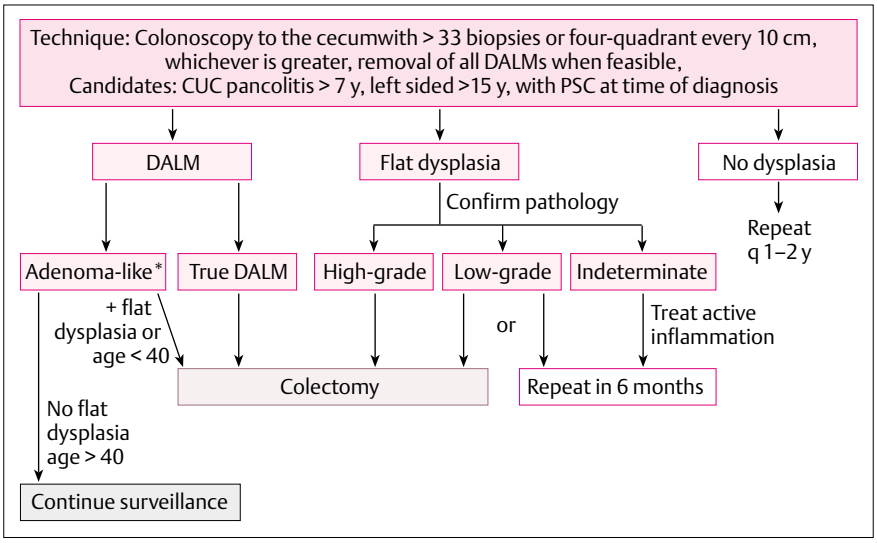

Erratum

In reviewing the final copy of the "Inflammatory Bowel Disease" Review article in the February 2001 issue of "Endoscopy", there is a missing arrow in the Figure **1**. Under Dalm — Adenoma-like, there should be an arrow next to the text "+ flat dysplasia or age < 40" leading from the box enclosing "adenoma-like" to the box enclosing "colectomy". It is now shown in the corrected figure.