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CASE REPORT

Computed tomography virtual endoscopy with angiographic imaging for the treatment of type Ⅳ-A choledochal cyst

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Abstract

Type Ⅳ-A choledochal cysts (CCs) are a congenital biliary anomaly which involve dilatation of the extrahepatic and intrahepatic bile ducts. We present the case of a 30-year-old woman with type Ⅳ-A CC, on whom three-dimensional computed tomography (3D CT) and virtual endoscopy were performed. 3D CT revealed partial dilatation in the posterior branch of the intrahepatic bile duct and a relative stricture between it and the extrahepatic bile duct. Virtual endoscopy showed that this stricture was membrane-like and separated from the surrounding blood vessels. Based on these image findings, complete cyst resection, bile duct plasty for the stricture, and hepaticojejunostomy were safely performed. To the best of our knowledge, there are no reports of imaging by virtual endoscopy of the biliary tract which show the surrounding blood vessels running along the bile duct.

Key words: Choledochal cyst; Bile duct dilatation; Computed tomography; Virtual endoscopy; Bile duct plasty

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INTRODUCTION

Choledochal cysts (CCs), namely, congenital bile duct dilatation, are high-risk factors for biliary tract cancer[1,2]. Almost all cases of type I and type Ⅳ-A CCs are associated with pancreaticobiliary maljunction, and preventative diversion surgery is performed even without the presence of cancer[3]. Type Ⅳ-A CCs involve dilatation of the extrahepatic and intrahepatic bile ducts, and relative stricture at the junction of both is often observed. If this stricture is left alone, several complications, including cholangitis, hepatolithiasis, and cholangiocarcinoma may occur after surgery. Therefore, bile duct plasty for stricture or bile duct resection which includes the stricture site is required[4,5]. Moreover, if the stricture or cyst is present in the intrahepatic bile duct, hepatectomy is required to remove these lesions[4,6]. Accordingly, for type Ⅳ-A CCs, a thorough examination of the biliary tract is necessary before surgery. Recently, three-dimensional (3D) imaging and virtual endoscopy based on computed tomography (CT) or magnetic resonance images have often been used for the evaluation of biliary tract anatomy and disease detection[7-10]. Here, we report a case of type Ⅳ-A CC in which the condition of the bile duct stricture and blood

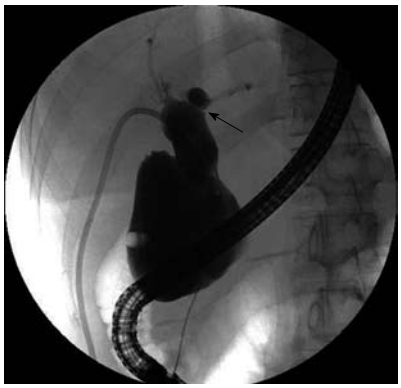

Figure 1 Percutaneous transhepatic bile duct drainage cholangiography demonstrating a cystic dilatation of the common bile duct and relative stricture (arrow) between the extrahepatic and intrahepatic bile ducts.

vessels running along the CC were confirmed by 3D CT imaging and virtual endoscopy, and surgery was safely performed.

CASE REPORT

A 30-year-old woman was admitted to a local hospital because of cholangitis during late pregnancy. Since marked dilatation of the common bile duct and jaundice were observed, she underwent percutaneous transhepatic bile duct drainage (PTCD). She was given a diagnosis of type Ⅳ-A CC with pancreaticobiliary maljunction and was transferred to our department for surgery. We performed cholangiography by injecting a contrast medium *via* a PTCD tube, and imaging data at 1 mm intervals obtained by multislice CT was evaluated using a 3D image analytic system (Synapse Vincent FN-7941; Fuji Film Medical Co., Ltd., Tokyo, Japan).

PTCD cholangiography and endoscopic retrograde cholangiopancreatography (ERCP) revealed marked cystic dilatation in the common bile duct (Figure 1). The end of the common bile duct was obstructed, and communication between the bile duct and the side of the papilla was not observed. Moreover, stricture was found in the transition site, which was assumed to be between the left hepatic duct and the intrahepatic bile duct. On a 3D image of the biliary tract, no dilatation in the anterior branch or the lateral branch of the intrahepatic bile duct, and no relative stricture of the extrahepatic bile duct were observed. However, the posterior branch showed partial dilatation in the transition site from the extrahepatic bile duct, and relative stricture was observed in the transition site, but with no stricture or dilatation in the peripheral bile duct (Figure 2).

A virtual endoscopic image of the biliary tract showed no stricture in the orifice of the anterior branch, but the presence of a membrane-like stricture in the orifice of the posterior branch was confirmed (Figure 3A). Furthermore, when this image was overlapped with blood vessel images obtained by 3D imaging, the distribution of a blood vessel system around the biliary tract was clearly

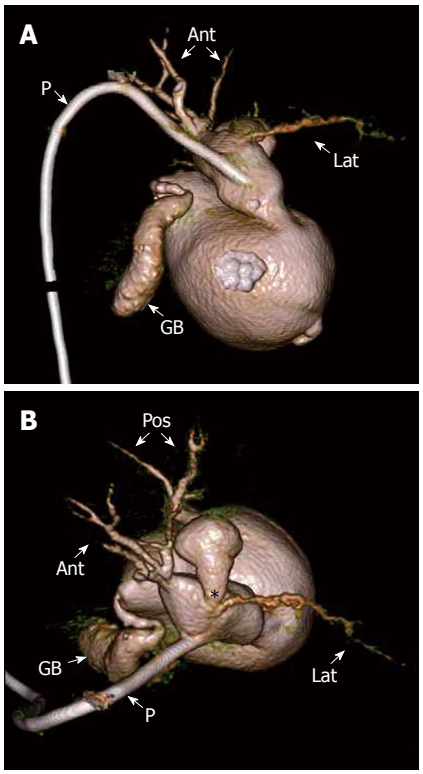

Figure 2 Three-dimensional image. A: Three-dimensional (3D) frontal image demonstrating no stricture or dilatation of the anterior and lateral branches of the bile duct; B: 3D head image showing a relative stricture (*) and partial dilatation of the posterior branch of the bile duct. P: Percutaneous transhepatic bile duct drainage tube; GB: Gallbladder; Ant: Anterior branch; Pos: Posterior branch; Lat: Lateral branch.

observed. This image showed that blood vessels did not run in the membrane-like stricture (Figure 3B).

During surgery, the gallbladder and dilated extrahepatic bile duct were removed. Next, the membrane-like stricture of the posterior branch was cut by several mm, and each cut end was sutured with 2 stitches of 5-0 absorbable sutures. This alleviated the relative stricture, and the orifice of the posterior branch expanded sufficiently (Figure 4). Finally, the bile ducts on the hepatic side and jejunum were anastomosed. In the histopathological findings of the resected specimen, chronic inflammation and hyperplasia of the gallbladder and bile duct were observed, but no malignancy was observed. One year after surgery, no complications, including cholangitis or hepatolithiasis, have been observed.

DISCUSSION

3D imaging and virtual endoscopy based on reconstructed CT images have been performed since the early 1990s, and have been applied in various fields. Initially, the images obtained were comparatively rough because they were taken from helical CT[7], but with the introduction of multislice CT, it has become possible to obtain images almost as clear as those obtained in cholangioscopy[8]. This imaging modality has 93% sensitivity in visualizing the biliary tract, 90% sensitivity in visualizing CCs, and 93%

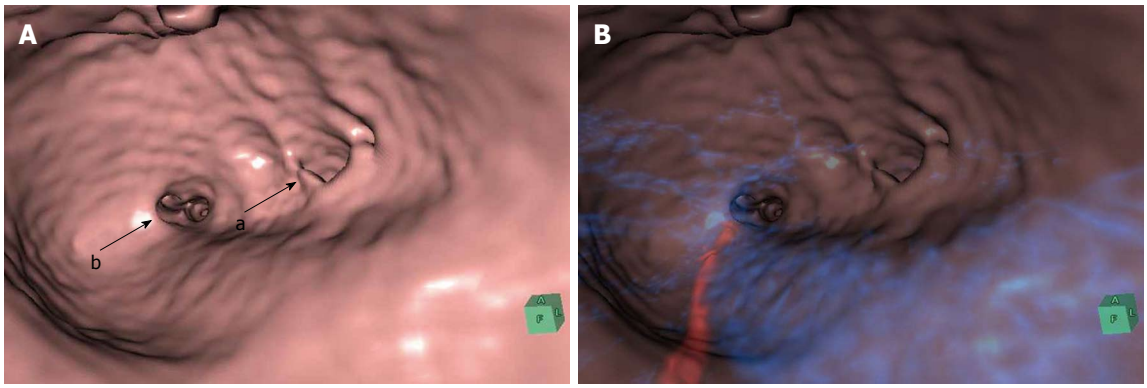

Figure 3 Virtual cholangioscopy. A: Virtual cholangioscopy demonstrating a relative stricture of the orifice in the posterior branch (a) and no stricture in the anterior branch (b); B: Composite virtual cholangioscopy demonstrating no relationship between the membrane-like stricture and the surrounding blood vessels. Red indicates the hepatic artery and blue denotes the portal vein.

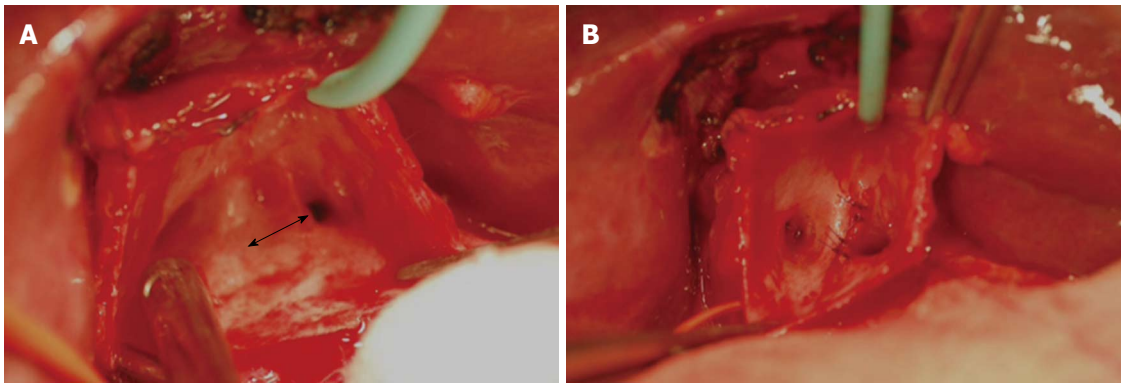

Figure 4 Operative findings. A: A membrane-like stricture, which was cut along the arrow line; B: Bile duct plasty was safely performed.

sensitivity in the diagnosis of lithiasis[11]. Conventionally, ERCP is considered to be the best imaging modality for CCs, but its application has become less with the appearance of virtual endoscopy[11]. One reason for this is that ERCP is invasive and poses the risk of complications including bleeding, cholangitis or pancreatitis. Moreover, if there is partial or complete obstruction of the bile duct, imaging of the peripheral bile duct may also be poor. Furthermore, since a high volume of contrast medium is needed to visualize CCs, there is a risk of missing small lesions in the biliary mucosa. In the present case, since the end of the common bile duct was completely obstructed, neither ERCP nor direct cholangioscopy could be performed. PTCD cholangiography revealed that there was a relative stricture in the transition site, which was assumed to be present between the left hepatic duct and the intrahepatic bile duct, but was clearly shown in the posterior branch of the bile duct by 3D imaging and virtual endoscopy. These results indicate that 3D imaging and virtual endoscopy can be very useful in understanding the anatomy of the biliary tract.

The basic surgical treatment for type Ⅳ-A CCs is as follows[4,12]: (1) the gallbladder and extrahepatic bile duct portions with high carcinogenetic risk are completely removed; (2) if the transition site of the extrahepatic bile duct and intrahepatic bile duct is narrow, bile duct plasty for stricture is performed; (3) if stricture or dilatation is observed in the intrahepatic bile duct, hepatectomy is also performed; and (4) during hepaticoenterostomy, a wide anastomotic stoma is formed to prevent cholangitis due to anastomotic stricture. In the present case, the posterior branch of the bile duct showed partial dilatation from the transition site from the extrahepatic bile duct, and a relative stricture was observed in the transition site. Moreover, according to the virtual endoscopic findings, this was a membrane-like stricture, and bile duct plasty was performed. There was no other stricture or dilatation in the intrahepatic bile duct, thus hepatectomy was not required. In the present case, by confirming blood vessels running around the bile duct using virtual endoscopy, the risk of mistakenly cutting the blood vessels by bile duct plasty could be avoided. To the best of our knowledge, there are no reports considering the overlapping of surrounding blood vessels running on the same image through observation of the bile duct by virtual endoscopy. Since the hepatic artery, and often the portal vein, may become displaced by a dilated cyst, caution is required in performing surgery of CCs. The present results clearly show that CT virtual endoscopy greatly contributes to the diagnosis and treatment of CCs.

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