

CT features of juxtapaillary duodenal diverticula with complications

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Objective: We evaluated the computed tomography (CT) features of juxtapaillary duodenal diverticula (JPDD) with complications in patients who had acute abdomen.

Materials and Methods: Nineteen JPDD were evaluated in 14 patients (mean age: 50 years), who had acute abdomen on contrast-enhanced helical CT with a diagnosis of complicated JPDD by endoscopic retrograde cholangiopancreatography (ERCP). The size, number, and contents of the JPDD, pancreaticobiliary ductal dilation, biliary stones, and other associated findings were evaluated on CT scans.

Results: Eighteen of the 19 JPDD (94.4%) containing air were demonstrated by CT. Their diameter ranged from 20 to 40 mm (mean: 30 mm). Common bile duct dilation was visualized in 12 patients and biliary stones were found in 8 patients. The other findings were cholecystitis, cholangitis, pancreatitis, and liver abscess. The most serious complication was perforation into the retroperitoneal space caused by diverticulitis associated with an enterolith.

Conclusion: Complicated JPDD were well depicted on CT scans, and various findings were revealed. CT evaluation of complicated JPDD was useful for management of these patients.

Key words: juxtapaillary duodenal diverticula, complication, CT

INTRODUCTION

Juxtapaillary duodenal diverticula (JPDD) are common and are usually asymptomatic. However, pancreaticobiliary disease associated with JPDD has been reported as so-called Lemmel's syndrome [1-7]. Recurrent choledocholithiasis is associated with JPDD in patients who have undergone cholecystectomy. The most serious complication of JPDD is perforation, and it requires early surgical treatment [8-10]. The majority of JPDD are detected incidentally by upper gastrointestinal tract studies or endoscopic examination. JPDD can be problematic in patients who undergo endoscopic retrograde cholangiopancreatography (ERCP) because cannulation of the bile duct is difficult if the ampulla drains into a diverticulum [11, 12]. Because the initial imaging examination is often computed tomography (CT) in patients with acute abdomen, it is important to detect JPDD and their complications by emergency CT.

The aim of this study was to evaluate the CT features of JPDD with complications in patients suffering from acute abdomen who also underwent ERCP.

MATERIALS AND METHODS

Informed consent was not required, because this was a retrospective study approved by our institutional review board.

We reviewed 19 JPDD in 14 patients (7 men and 7 women aged from 68 to 86 years; mean age: 50 years) with acute abdomen. CT was performed to investigate abdominal pain (n=8), jaundice (n=5), and suspected

pancreatitis (n=1). All patients were diagnosed as having complications of JPDD by ERCP within 7 days after CT scanning. All patients underwent emergency contrast-enhanced CT of the upper abdomen before ERCP. In 7 patients, ERCP was performed for endoscopic sphincterotomy (EST) and extraction of common bile duct (CBD) stones. In another 7 patients, ERCP was performed to exclude CBD stones. In 1 patient, endoscopic examination was performed to assess the relation of the diverticulum to the papilla. In all patients, cannulation to the papilla by ERCP was achieved despite the presence of JPDD. Stenting of the bile duct was not performed. Surgical treatment was required in one patient with Mirizzi syndrome.

Intravenous contrast agents were administered to 13 of the 14 patients, and helical CT scanning was performed in 7 patients before and after contrast enhancement. Oral contrast agents were not used. Multi-detector-row CT (MDCT) was performed in 5 patients using a SOMATOM Emotion 6 (Siemens, Forchheim, Germany) and an Aquilion (Toshiba, Tokyo, Japan). Single helical CT (SDCT) was performed in 9 patients using a Proseed Accsell (GE Yokokawa Medical Systems, Tokyo, Japan). In 11 patients undergoing routine abdominal CT, the parameters were as follows (protocol 1): collimation of 10 mm, 1 : 1 pitch, and reconstruction with a slice thickness of 10 mm for SDCT in 5 patients; as well as collimation of 3 mm, pitch of 1 : 5-7, and reconstruction with 7-mm slices for MDCT in 6 patients. A total of 100 mL of nonionic contrast medium (300 mgI/mL) was injected intravenously at a rate of 1-2 mL/s. Helical CT was done at 70-100

Table 1 CT features of JPDD

AF: air and fluid, AS: air and soft tissue, AFS: air, fluid, and soft tissue

A: The papillary orifice located on the anal side of the JPDD.

B: The papillary orifice located between two JPDD.

Case 12: * The papilla was thought to be located on the anal side because a 10-mm JPDD was not detected by CT.

No. of Pt..	No. of JPDD	Inflamed JPDD	Size of JPDD (mm)	Contents of JPDD	Location of papilla
1	1	-	30	AF	A
2	1	-	40	AF	A
3	2	-	35. 30	AS. AS	B
4	1	+	30	AFS	A
5	1	-	20	AF	A
6	1	-	20	AF	A
7	1	-	20	AS	A
8	2	-	30. 25	AF. AF	B
9	1	-	40	AF	A
10	1	-	40	AF	A
11	1	-	30	AF	A
12	2 (1)*	-	25 (10)*	AF	A (B)*
13	2	-	20. 20	AF. AF	B
14	2	-	30. 40	AF. AF	B

Table 2 CT features of JPDD with complications

CBD: Common bile duct, IHBD: Intrahepatic duct, PD: Pancreatic duct

CS: Stone of common bile duct, GS: Gallbladder stone, IS: Stone of intrahepatic duct

No. of Pt.	Dilatation of duct	Stone	Other findings
1	-	CS, GS	cholecystitis, pleural effusion
2	CBD, IHBD	CS, GS, IS	pancreatitis
3	CBD, IHBD	-	cholecystitis, cholangitis, liver abscess
4	-	-	retroperitoneal perforation
5	CBD	GS	cholecystitis
6	CBD, IHBD, PD	CS	cholecystitis, pancreatitis
7	CBD, IHBD, PD	CS, GS	cholecystitis, liver abscess
8	CBD, IHBD	-	cholangitis
9	CBD, PD	-	cholangitis
10	CBD, PD	-	cholangitis
11	CBD	CS	cholangitis
12	CBD	CS, GS	cholecystitis, cholangitis
13	CBD	-	cholecystitis, cholangitis
14	CBD	CS	pancreatitis

seconds after injection of the contrast. In 2 patients who underwent dynamic CT to rule out pancreatic or liver tumors, the parameters were as follows (protocol 2): collimation of 5 mm, 1 : 1 pitch, and reconstruction with 5-mm slices for SDCT in 1 patient; as well as collimation of 2 mm, pitch of 1 : 7, and reconstruction with 5-mm slices for MDCT in 1 patient. Dynamic CT was performed with an injection rate of 3 or 4 mL/s and a total volume of 100 mL of contrast medium. Dynamic CT scans were obtained at 30 seconds after the injection of contrast for the arterial phase, at 60 seconds for the portal phase, and at 150 seconds for the delayed phase.

The CT scans were reviewed by 2 radiologists who had more than 15 years of experience with the interpretation of abdominal images. Any differences of opinion were resolved by consensus. The size, number, location, and contents of the JPDD, as well as mural inflammation, pancreaticobiliary ductal dilation, biliary stones, and other associated findings were evaluated on CT.

RESULTS

Eighteen of the 19 JPDD (94.7%) containing air were demonstrated by CT (Table 1). The diameter of the JPDD ranged from 20 to 40 mm (mean: 30 mm) on CT scans. The diverticula were seen as pouches in the duodenal wall with air and fluid contents. Fourteen JPDD contained air and fluid alone, 1 contained air, fluid, and soft tissue, and 3 had air and soft tissue. Thus, air was always visualized within the JPDD. The papillary orifice was located on the anal side of the diverticulum (n=9) or between two JPDD (n=3) on axial CT scans. In one patient, the smaller of two JPDD could not be detected by CT, so the papilla was diagnosed as being located distal to the diverticulum. One diverticulum had mural inflammation associated with retroperitoneal perforation. Table 2 showed complications of JPDD on CT. Dilation of the CBD was visualized in 12 patients, dilation of intrahepatic bile ducts was seen in 5 patients, and dilation of the pancreatic duct was noted in 4 patients. CBD

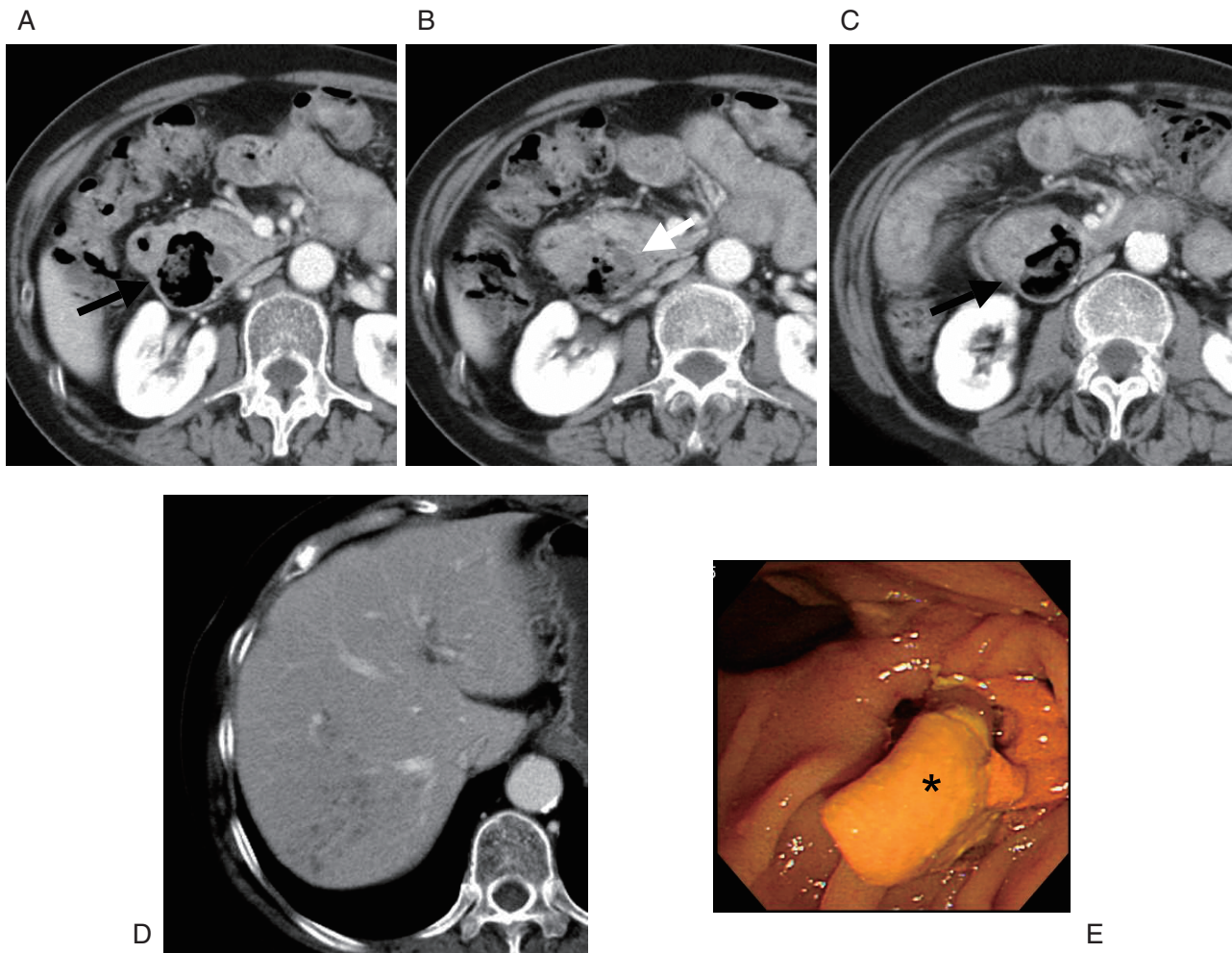


Fig. 1. A 70-year-old man with cholecystitis, cholangitis, and liver abscess. Axial CT scans show two JPDD (black arrows: A, C) containing food debris. The common bile duct is located between the two JPDD (B). Note multiple small low-density nodules consistent with liver abscesses (D). Endoscopy reveals two JPDD containing impacted food debris (asterisk). The diverticulum on the oral side (arrowhead) was cleaned by retrieval of an enterolith and food debris (E).

stones were noted in 7 patients and gallbladder stones were seen in 5 patients. One patient had a stone in an intrahepatic bile duct. Other associated findings were cholecystitis (n=7), cholangitis (n=7), pancreatitis (n=3), and liver abscess (n=2). One patient had a right pleural effusion associated with cholecystitis (Table 2). The papillary orifice was compressed between two JPDD containing food debris in one patient who also had cholecystitis, cholangitis, and liver abscess (Figure 1). The case of perforation into the retroperitoneal space was due to diverticulitis associated with an enterolith (Figure 2).

DISCUSSION

JPDD are common and, but are usually asymptomatic and are discovered incidentally. Complications of JPDD are rare, e. g., Whitcomb *et al.* reported complications in only one out of 1,064 persons with JPDD [13]. Numerous complications of JPDD have been reported, including choledocholithiasis, cholecystolithiasis, cholecystitis, cholangitis, and pancreatitis [1-7]. Most patients with complications have chronic symptoms. Because patients with acute abdomen usu-

ally undergo emergency CT before endoscopy or a barium study, it is important to detect JPDD and any associated complications on CT scans for their successful management. Surgical treatment, predominantly for complications, is only required in 1-2% of patients with duodenal diverticula [9, 14, 15], with the complications being hemorrhage, diverticulitis, perforation, pancreatitis, and biliary obstruction. Liver abscess was found in two patients without gallbladder stones in our series, but very few cases of liver abscess associated with JPDD have been reported previously. Perforation of JPDD is fortunately rare although it is the most serious complication. The causes of perforation include diverticulitis, enterolithiasis, ulceration, increased intraluminal pressure, foreign bodies, blunt trauma, and gallstones [9]. In our patient with perforation, CT was helpful for identification of retroperitoneal air and also revealed a diverticulum containing an enterolith (Figure 2). In another patient with JPDD containing enteroliths and food debris, perforation was not seen, but the patient had liver abscess, cholecystitis, and cholangitis (Figure 1). These complications improved after removal of enteroliths and food debris from the

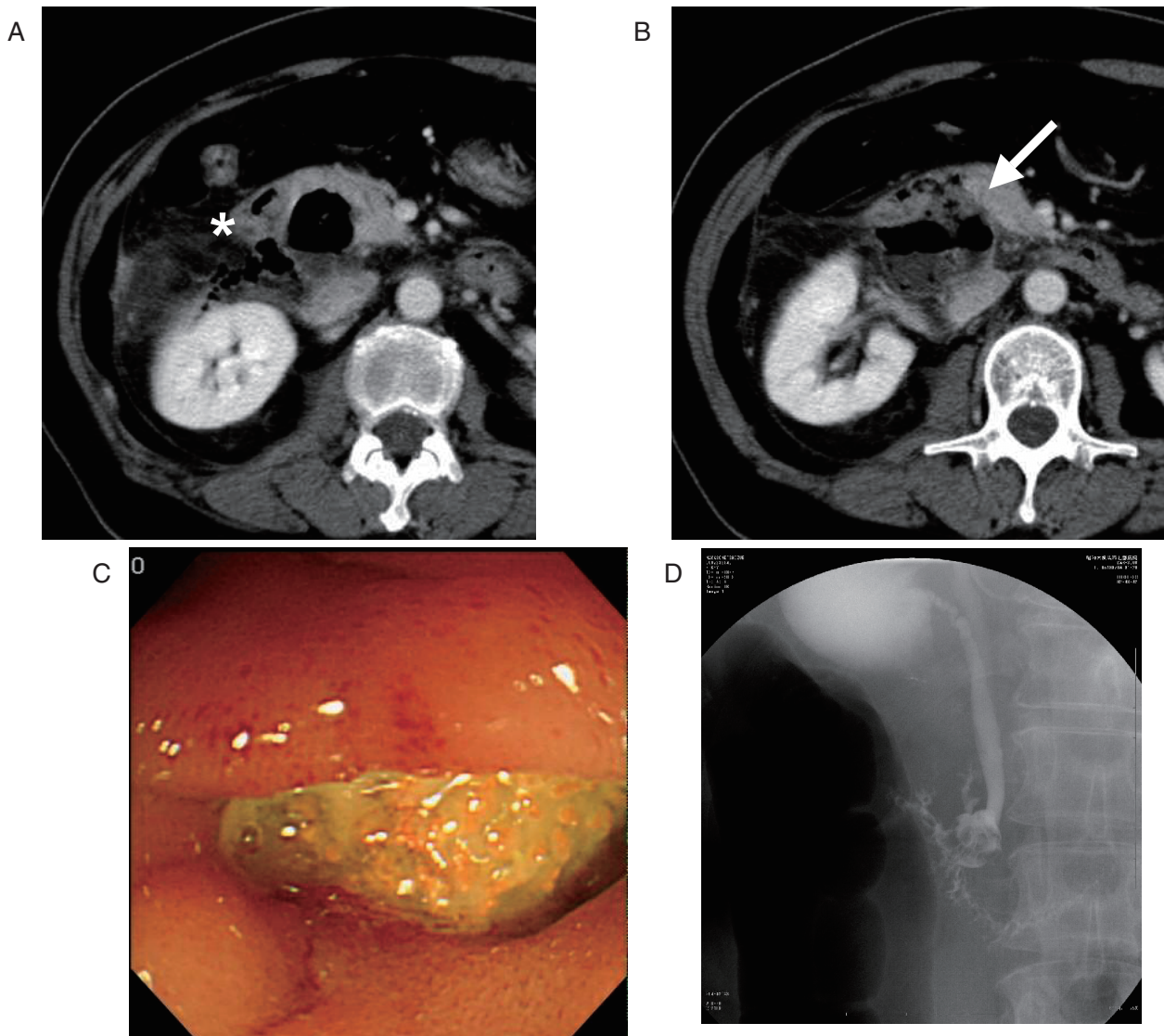


Fig. 2. A 65-year-old man suffering from retroperitoneal perforation of a JPDD with an enterolith. Axial CT scans (A, B) show abnormal retroperitoneal air (asterisk) adjacent to a large JPDD with an enterolith (arrow). Endoscopy reveals a juxtapapillary diverticulum with an impacted enterolith (C). ERCP shows a filling defect within the diverticulum and extravasation of contrast medium into the retroperitoneal space (D).

JPDD and or treatment with medications. The risk of perforation for JPDD containing enteroliths and food debris may be higher than for those that only contain fluid or air, so it is important to detect the presence of a solid component within the diverticulum on CT scans.

JPDD can be discovered incidentally on upper gastrointestinal barium studies. These structures arise within a radius of 2-3 cm from the ampulla of Vater [6, 16]. They are usually depicted well by CT if they are filled with fluid and air and are located in the characteristic peripapillary region [17, 18]. The typical CT appearance of JPDD has been described as a thin-walled, round collection of air that also contains oral contrast medium if CT scans are obtained with oral contrast to delineate the gastrointestinal tract [18]. Complicated JPDD can be distinguished from normal JPDD by CT scanning. All JPDD containing air were demonstrated by CT in our series. Three JPDD con-

tained soft tissues consistent with enteroliths and food debris. CT misinterpretation of JPDD as pancreatic tumors, metastatic lymph nodes, pancreatic pseudocysts, or pancreatic abscesses has been reported if the contents are fluid without air or the diverticulum is small [18, 19].

The mean diameter of the JPDD detected by CT was 27.8 mm in our series. In a patient with Mirizzi syndrome, the diverticulum was 20 mm in diameter and thus was not so large. Occurrence of complications is related to the intradiverticular pressure rather than the size of JPDD. In our series, the papillary orifice was adjacent to a diverticulum or between two JPDD, but was not located deep within these structures. JPDD can be problematic in patients with pancreaticobiliary disease who undergo ERCP because cannulation of the bile duct is difficult if the ampulla drains into the diverticulum [11, 12]. In fact, cannulation may be hazardous or impossible if the diverticulum has a

narrow neck and the papilla is located at the fundus. Therefore, prior detection of JPDD and assessment of their relation to the ampulla can be useful when planning this procedure. Some authors have reported that the location of the papillary ostium was better visualized on coronal MRI images [18, 21]. Magnetic resonance cholangiopancreatography (MRCP) images obtained in the coronal plane were found to best demonstrate the relationship between the diverticulum and the papilla [21]. Two patients in our series underwent secretin-stimulated MRCP, and reflux of pancreatic juice into the JPDD was clearly demonstrated after secretin injection.

In patients with gallbladder stones, cholecystectomy is commonly performed without preoperative ERCP or an upper gastrointestinal barium study. In these patients, common bile duct (CBD) stones can occur due to compression of the distal CBD by the JPDD or incompetent sphincter of Oddi reflux of duodenal contents [18]. Accumulation of β -glucuronidase-producing micro-organisms leads to the formation of pigment stones in the CBD in patients with JPDD [16, 18, 22]. If a patient has a diverticulum, stones are much more likely to be pigmented and to recur after cholecystectomy. In our series, only one patient was post-cholecystectomy, and had no evidence of recurrent common bile duct stones. However, the patient complained of recurrent abdominal pain which may have been due to biliary stasis because of compression of the distal CBD by the diverticulum or incompetence of the sphincter of Oddi.

In conclusion, we evaluated the CT findings in patients with a diagnosis of complicated JPDD by ERCP. Eighteen out of 19 diverticula (94.4%) were demonstrated by CT. The CT findings of the complications were variable. Evaluation of the complications of JPDD by CT was useful for successful management of these patients.

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