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CT imaging of biliary enteric fistula

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Abstract

Background: To define the signs useful for differentiating between gallbladder–enteric fistula (GB-EF) and common bile duct–enteric fistula (CBD-EF) on computed tomography (CT) because the prognosis and management of the two are different.

Methods: CT scans in 13 patients with pneumobilia, who had not had surgical biliary–enteric anastomosis and endoscopic sphincterotomy, were reviewed. The presence of fistula itself, the location of air in the biliary system, and the appearance of the gallbladder were assessed.

Results: The causes of pneumobilia were GB-EF in seven patients, CBD-EF in three patients, emphysematous cholecystitis (EC) in one patient, gallbladder cancer (GBC) in one patient, and incompetent sphincter of Oddi in one patient. In three of seven GB-EF patients (43%) and in none of the three CBD-EF patients (0%), the fistula itself was detected. Air was detected in the common bile duct in four of seven GB-EF (57%) and in all three CBD-EF (100%) patients, and GBC. In six of seven GB-EF (86%) and in one of three CBD-EF (33%) patients, the gallbladder was contracted. Thus, the location of air and the contraction of gallbladder were useful signs to differentiate GB-EF from CBD-EF.

Conclusion: CT can distinguish between GB-EF and CBD-EF.

Key words: CT—Biliary enteric fistula—Pneumobilia—Cholecystoduodenal fistula—Choledochoduodenal fistula—Cholecystocolic fistula.

A biliary–enteric fistula (B-EF) can form between any part of the extrahepatic biliary system and any adjacent portion of the gastrointestinal tract. These spontaneous fistulas are usually complications of long-standing calculous biliary tract disease and less frequently associated with ulcerative disease of gastrointestinal tract or malignant tumors of adjacent organs. The diagnosis is suspected whenever air is demonstrated within the biliary system on roentgenographic examination.

There are two types of fistula. The fistulous tract forms between the gallbladder and the gastrointestinal tract or forms between the common bile duct and the gastrointestinal tract. It is important to differentiate between the two types of fistula because the prognosis and management of the two are different [1, 2]. Although pneumobilia without a history of surgery usually indicates B-EF, there are some differential diagnoses.

The purpose of this paper is to not only differentiate B-EF and other causes of pneumobilia but also define the signs useful for differentiating between gallbladder–enteric fistula (GB-EF) and common bile duct–enteric fistula (CBD-EF) on computed tomography (CT).

Materials and methods

We retrospectively analyzed CT scans in 13 (seven men, six women; mean age = 65 years, range = 47–86) patients with pneumobilia, who had not had surgical biliary–enteric anastomosis, endoscopic examinations, or sphincterotomy. Scans were obtained from January 1988 to February 1996. The patients had fasted more than 3 h before CT examination. CT findings were correlated with the results of surgery or endoscopic retrograde cholangiopancreatography (ERCP).

CT scans were obtained with 10-mm collimation and 10-mm intervals. In the contrast-enhanced study, 100 mL of iopamidol (300 mgI/mL, Iopamilon 300, Nihon Schering, Japan) were injected intravenously. The scans were obtained from the level of diaphragm to the level of the inferior end of the kidneys. The presence of fistula itself, the location of air in the biliary system, and the appearance of gallbladder were assessed.

Results

The cause of pneumobilia were GB-EF in seven (cholecystocolic in one and cholecystoduodenal in six) pa-

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Fig. 1. *Cholecystoduodenal fistula.* Enhanced CT shows a narrow fistula (*arrow*) between the gallbladder (*solid arrow*) and the duodenum (*open arrow*). Air–fluid level was demonstrated in the contracted gallbladder.

Fig. 2. *Cholecystocolic fistula*. Enhanced CT shows a narrow fistula (*arrow*) between the gallbladder (*solid arrow*) and the colon (*open arrow*). Air–fluid level was demonstrated in the contracted gallbladder, as in Figure 1.

Fig. 3. *Incompetent sphincter of Oddi.* Plain CT shows air–fluid level (*arrow*) in the normal gallbladder.

Fig. 4. *Emphysematous cholecystitis.* Unenhanced CT demonstrates irregular linear air collection (*arrow*) in the wall of the enlarged gallbladder.

tients, CBD-EF in three (all were choledochoduodenal), EC in one patient, gallbladder cancer (GBC) with gas-forming infection in one patient, and incompetent sphincter of Oddi (ISO) in one patient.

A fistula itself was detected in three of seven GB-EF patients (43%) and in none of the three CBD-EF patients (0%). Fistulous tracts were narrow and there was an approximation of gallbladder and involved organs (Figs. 1, 2).

Air was detected in the gallbladder in six of seven GB-EF (86%) patients, two of three CBD-EF (67%) patients, and all patients of the other three diseases. Air–fluid level was demonstrated in the gallbladder in all GB-EF, CBD-EF, and one ISO patients (Fig. 3). In an EC patient, irregular linear air collection was detected in the wall of gallbladder (Fig. 4). In a GBC patient, CT demonstrated bubbly appearance of air collection in the enlarged gallbladder (Fig. 5).

Air was detected also in the common bile duct in four of seven GB-EF (57%) patients, all CBD-EF (100%) patients (Fig. 6), and GBC.

In six of seven GB-EF (86%) patients and one of three CBD-EF (33%) patients, the gallbladder was contracted (Fig. 7A,B). The size of the gallbladder was normal in one ISO patient and was large in an EC and a GBC patient.

Discussion

Spontaneous B-EF has been observed between different portions of the extrahepatic biliary system and a variety

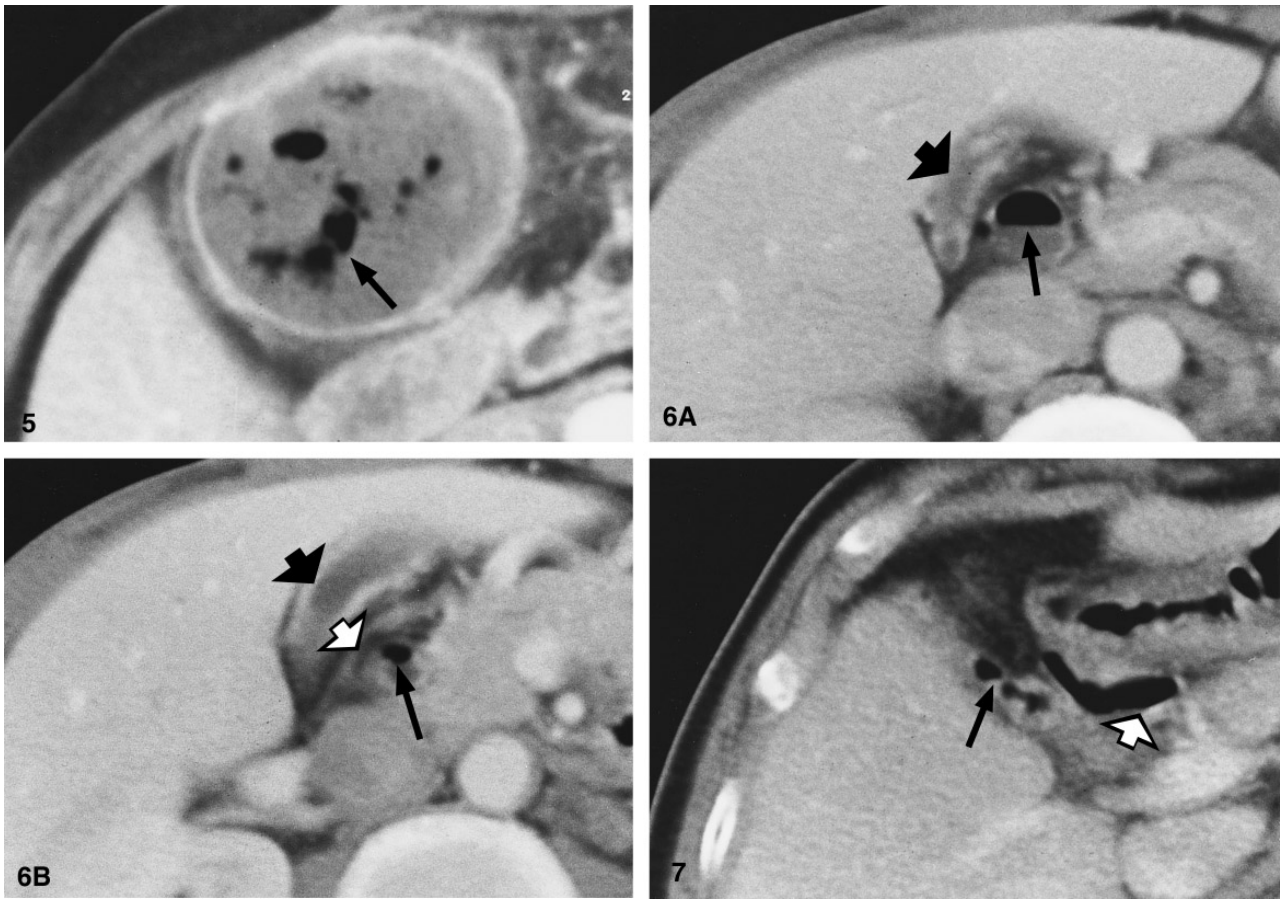

Fig. 5. *Gallbladder cancer with gas-forming infection.* Enhanced CT shows bubbly air collection (*arrow*) in the enlarged gallbladder. Surgery confirmed that the air collection was detected in the large necrotic polypoid cancer.

Fig. 6. *Choledochoduodenal fistula.* **A,B** Enhanced CT shows air–fluid level in the dilated common bile duct (*arrow*). The duodenum (*open arrow*) was detected between the gallbladder (*solid arrow*) and the common bile duct.

Fig. 7. *Cholecystoduodenal fistula.* Enhanced CT showed air–fluid levels in the contracted gallbladder (*arrow*). There were no apparent fistulae between the duodenum (*open arrow*) and the gallbladder.

of adjacent organs. Spontaneous communication is caused by the erosion of a gallstone in 90% of cases, the penetration of a peptic ulcer in 6%, and tumor or trauma in 4% [3].

The typical patient is in the sixth or seventh decade of life. Fistulae have been reported to occur in 0.9% of patients with biliary disease [4]. The majority of patients have pain in the right upper quadrant, nausea, vomiting, and fatty food intolerance. These symptoms are characteristic of cholecystitis and are not helpful in making the diagnosis of a fistula. Eighty-seven percent of patients have reported 2–10 times the number of similar attacks of 6 months to 20 years duration [5].

Radiographic features of B-EF are typical. Plain abdominal radiographs may reveal air in the biliary system. However, this finding has been reported to occur in about 5–10% of cases [6]. Of our 13 patients, only five demonstrated this finding. Balthazar and Schechter suggested that two adjacent small air–fluid levels in the right upper quadrant on radiographs are the early signs of B-EF [7].

Upper gastrointestinal examination sometimes demonstrates barium accumulation in the fistula or right paraduodenal area. Ultrasound may reveal pneumobilia, gallstones, and common bile duct stones. Intravenous cholangiography usually demonstrates poor visualization of gallbladder in this condition, so it is not considered useful [8]. CT demonstrates a minimal amount of air and the location of air better than other diagnostic technique. ERCP may be more specific in demonstrating the fistula and presence of stones, but it cannot be done when there are deformity and narrowing of duodenal bulb secondary to inflammatory change.

Among the B-EF, cholecystoduodenal fistula is the most commonly seen, representing 64% of the B-EF. The other common B-EF are cholecystocolic (21%) and

choledochoduodenal (11.4%). Although cholecystoenteric fistulae are usually the result of cholecystitis, the choledochoduodenal fistula is commonly produced by perforation of a posterior wall duodenal ulcer into the adjacent common bile duct [9]. Although the presence of air or barium in the biliary systems is considered pathognomonic of the B-EF, there are other conditions that produce pneumobilia: infection (EC), gas-containing gallstones, neoplasm, trauma, ISO, and congenital anomalies.

It is important to differentiate not only biliary enteric fistula and other causes of pneumobilia but also GB-EF and CBD-EF because prognosis and treatment are different [1, 2]. In GB-EF, all patients undergo cholecystectomy and repair of the fistula [5]. In patients with CBD-EF, which is always choledochoduodenal, if the common bile duct is patent, the fistulous tract usually closes spontaneously in a few weeks. However, if the common duct is obstructed, the fistula acts as a permanent alternate route for the excretion of bile [10]. Bergner [6] suggested conservative treatment, and Michowitz et al. [11] agreed with his conclusion that radical surgery is very difficult, and therefore vagotomy and antrectomy are sufficient and give better results. However, when there is a stenosis with dilatation of the biliary tree, exploration of the bile ducts must be performed and a biliary enteric anastomosis may be required.

In our study, air was detected in the gallbladder in almost cases. However, the configuration of air collection was different. In EC, linear air collection in the wall is pathognomonic. Bubbly air collection in GBC was secondary to necrosis of the tumor, which was confirmed by surgery. Air–fluid level was demonstrated in all B-EF and ISO. ISO is a very rare disease, so it can be ruled out. Thus, the configuration of air collection seems to be a useful sign to distinguish B-EF from other causes of pneumobilia.

Air was also detected in all patients with CBD-EF and in some with another disease. Although our materials were not extensive, the presence of air in the common bile duct seems to be characteristic of CBD-EF in comparison with GB-EF.

In patients with cholecystitis and cholelithiasis, the inflamed gallbladder becomes adherent to the adjacent postbulbar duodenum; necrosis and perforation of the gallbladder and intestinal wall ensues, and infected bile and gallstones are eliminated from the intestinal tract. Decompression of the tense inflamed gallbladder by the discharge of its contents into the adjacent segment of intestinal tract is followed by the removal of the obstructing stone [4]. This decompression may be the reason the gallbladder was contracted on CT in six of our seven GB-EF patients. In EC and GBC, inflammation or the tumor itself may make the gallbladder larger than usual. In one of three patients with CBD-EF, CT showed contraction and wall thickening of gallbladder where surgery revealed chronically inflamed gallbladder with deep duodenal ulcer. The other two patients with CBD-EF had normal gallbladders. In CBD-EF, the fistula is formed between the common bile duct and the intestine, and there is no direct influence on the gallbladder. Therefore, the function and size of the gallbladder in CBD-EF is considered to be normal except when chronically inflamed. The presence of contraction of the gallbladder seems to be characteristic of GB-EF.

Newman reported a case of gallstone ileus in the absence of a biliary enteric fistula [12]. In this case, no fistula could be demonstrated at laparotomy or cholangiography, so it would seem that the stone had passed through a dilated ampulla of Vater. However, it is known that fistulae can close spontaneously [13]. In our cases, one CBD-EF was considered similar to this condition. This patient, whose cholelithiasis had been recognized 7 years before, was admitted with abdominal pain. CT showed pneumobilia without cholelithiasis, and then ERCP was performed and revealed a fistula between common bile duct and duodenum. Two years later, she was admitted again with abdominal pain. CT showed no pneumobilia, and surgery proved no evidence of a fistula.

In three of our seven patients with GB-EF, the fistula itself was detected. This sign is pathognomonic for B-EF.

As Radin and Santiago [14] reported, fistula formation is a rare sequela of carcinoma of the pancreas. Although the etiology of spontaneous pneumobilia is almost always benign, the possibility of a malignant biliary enteric fistula should be considered in a patient whose clinical and roentgenographic findings are not diagnostic of cholelithiasis or peptic ulcer disease. The fistula in the case of Radin and Santiago had a wide linear tract and lacked approximation of the involved viscera. These features may be characteristic of malignant fistulae of the gastrointestinal tract [14].

In conclusion, the location and configuration of air collection and the contraction of gallbladder could be useful signs to distinguish GB-EF from CBD-EF. The ability of CT to define these signs and its superior sensitivity in demonstrating fistula and pneumobilia are distinct advantages, compared with other radiographic methods [15].

Because CT is often done as the first study in the case of acute abdominal distress, the radiologist must be familiar with these features to diagnose B-EF.

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