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*Case report*

# Perforated duodenal diverticulum successfully diagnosed preoperatively with abdominal CT scan associated with upper gastrointestinal series

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Although duodenal diverticulum is not uncommon, precise preoperative diagnosis is occasionally difficult. We report a patient with perforated duodenal diverticulum successfully diagnosed preoperatively by an upper gastrointestinal series followed by abdominal computed tomography (CT) scanning. An 81-year-old Japanese woman visited a local hospital because of right-sided abdominal pain. Physical examination revealed diffuse muscle guarding localized in the entire right-side of the abdomen indicative of peritonitis. While plain abdominal X-ray film revealed no free air, abdominal ultrasound and abdominal CT scanning revealed fluid collection and gas in the anterior perirenal space. An emergency upper gastrointestinal series, using water-soluble contrast media, demonstrated multiple diverticula in the descending portion and the horizontal portion of the duodenum. Leakage of the contrast material was found by the upper gastrointestinal series followed by the abdominal CT scanning, suggesting that the peritonitis was caused by the perforated duodenal diverticulum, and an emergency laparotomy was performed. The diverticulum in the descending portion of the duodenum was mobilized from the retroperitoneum and complete resection and peritoneal drainage were performed. The resected specimen showed that the diverticulum was 42 × 23 mm in size, and two separate sites of perforation were identified. The present case suggests that upper gastrointestinal series followed by CT scan is useful for the preoperative diagnosis of perforated duodenal diverticulum.

**Key words:** duodenal diverticulum, perforation, retroperitoneal abscess, acute abdomen

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## Introduction

Although duodenal diverticulum is not uncommon, with diverticula occurring frequently along the entire gastrointestinal tract, few patients with duodenal diverticulum require surgical intervention for acute complications related to the condition. In particular, perforation of the duodenal diverticulum is the rarest complication in the majority of cases, and these complications require surgical treatment. However, preoperative diagnosis has been reported to be generally difficult, because the symptoms of the perforated duodenal diverticula are generally vague and nonspecific. Classically, operative mortality was reported to be 30%, which may be related to diagnostic delay.[1] Therefore, accurate preoperative diagnosis is important to improve the clinical outcome. We experienced a patient with perforated duodenal diverticulum that was successfully diagnosed (prior to emergency laparotomy) with an upper gastrointestinal series followed by abdominal computed tomography (CT) scanning, and was surgically treated without delay.

## Case report

An 81-year-old Japanese woman visited a local hospital because of right-sided abdominal pain, and she was referred to our hospital, because peritonitis was suspected. The patient had a history of total hysterectomy at age 76 years, due to uterine prolapse. Physical examination on admission indicated normal blood pressure, low-grade fever, and diffuse muscle guarding localized from the right hypochondrium through the entire right side of the abdomen, indicative of peritonitis. Laboratory data demonstrated leukocytosis (WBC count, 16800/μl) and an elevated C-reactive protein (CRP) level (2.1 mg/dl). Plain abdominal X-ray film revealed no free air. Abdominal ultrasound revealed fluid collec-

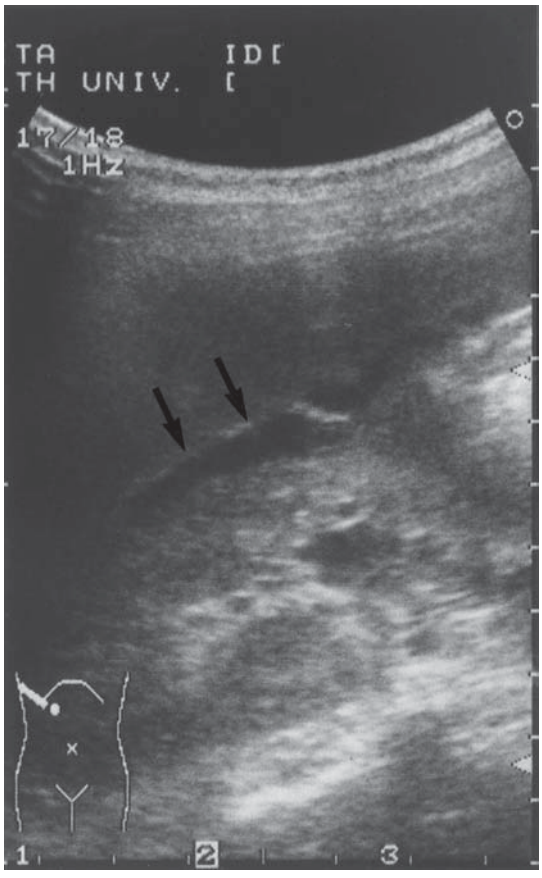


**Fig. 1.** Abdominal ultrasound examination performed on admission, revealing fluid collection (*arrows*) in the right anterior perirenal space

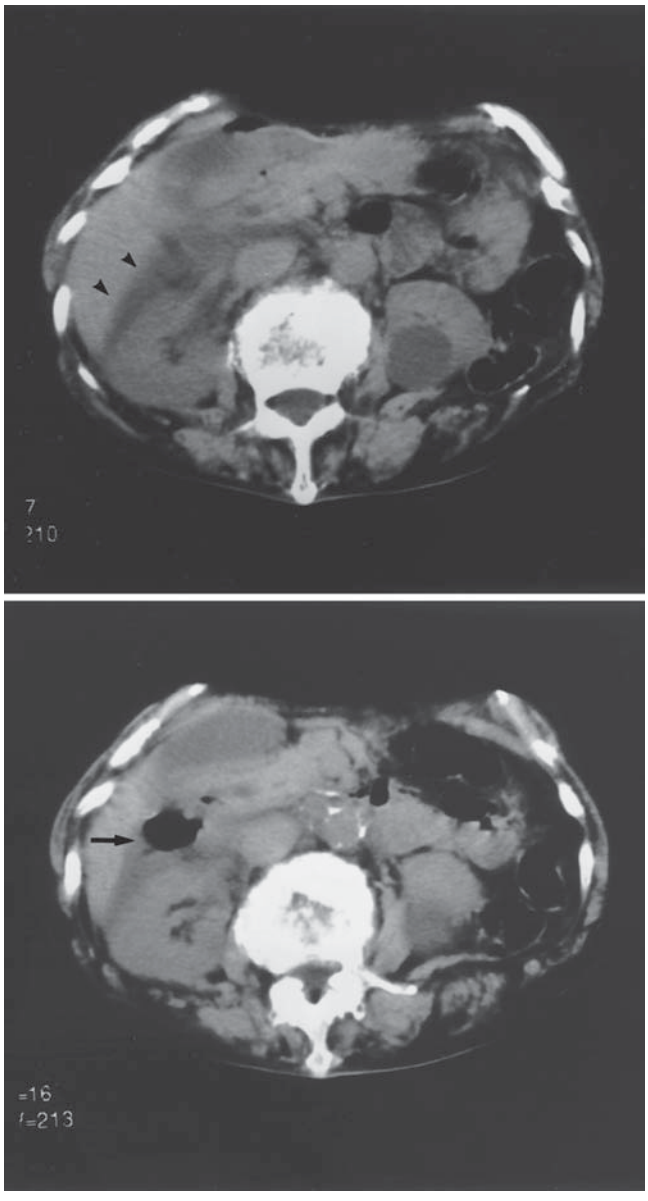


**Fig. 2A,B.** Abdominal computed tomography (CT) scanning performed on admission, revealing diffuse fluid collection (*arrowheads*) in the area ventral to the right kidney (**A**) and fluid associated with air (*arrow*); (**B**)

tion in the subhepatic space adjacent to Morrison's pouch, ventral to the right kidney (Fig. 1). Plain abdominal CT scanning revealed fluid collection in a diffuse area of the right anterior perirenal space (Fig. 2A). Air surrounded by the liver and the right kidney was noted (Fig. 2B). Perforated duodenum was suspected, and an upper gastrointestinal series was performed. Upper gastrointestinal series, using a water-soluble iodine contrast material through a duodenal tube, demonstrated multiple diverticula in the descending and horizontal portions of the duodenum (Fig. 3A). The largest diverticulum was located in the lateral side of the descending portion of the duodenum, and was found by the contrast media and the air filled inside the diverticulum. Contrast material was observed outside the diverticulum next to the air, and was considered to have leaked from the diverticulum (Fig. 3B). The shape of the diverticulum was outlined with the air in the diverticulum and with the contrast media leaked from the diverticulum (Fig. 3B). Abdominal CT scanning performed immediately after upper gastrointestinal fluorography also demonstrated that contrast media was accumulated in the diverticulum, and contrast media was noted in the right side of the retroperitoneum outside the duodenal diverticulum, suggesting that the contrast media had clearly leaked from the duodenal diverticulum (Fig. 4). These findings indicated that the peritonitis was caused by the perforated duodenal diverticulum, and an emergency laparotomy was performed.

A perforated duodenal diverticulum was found in the lateral side of the mid-portion of the descending portion of the duodenum, and a large amount of purulent fluid was found in the retroperitoneal space anterior to the

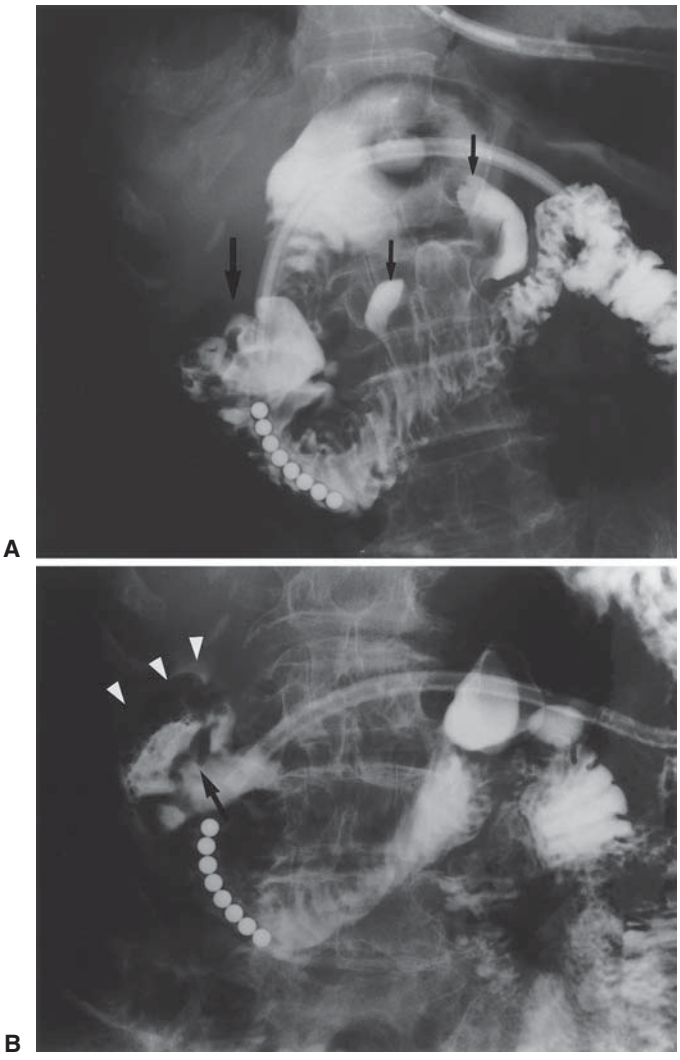


**Fig. 3. A** Multiple diverticula (*arrows*) were noted in the duodenum. **B** Contrast material (*arrowheads*) leaking from the diverticulum (*arrow*) in the lateral side of the descending portion was noted next to the air

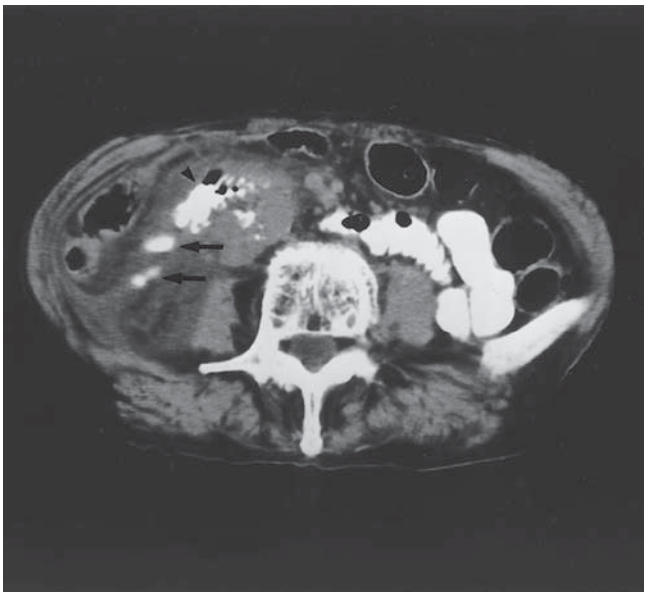

**Fig. 4.** Abdominal CT scan taken immediately after upper gastrointestinal fluorography, indicating that contrast media and air were accumulated in the diverticulum (*arrowhead*); contrast media (*arrows*) was found in the right anterior perirenal space, suggesting that the contrast media had leaked from the duodenal diverticulum

prerenal space. Suppurative inflammation associated with the collection of pus was noted in the area of the anterior right pararenal space. The diverticulum associated with the descending portion of the duodenum was mobilized from the retroperitoneum (Fig. 5A) and complete resection of the divertriculum was performed. The defective duodenal was after the removal of the perforated duodenal diverticulum was closed with two layers of interrupted sutures.

The resected specimen showed that the diverticulum was 42 × 33 mm in size, and two separate sites of perforation were identified at the distal portion of the diverticulum (Fig. 5B). Histological examination of the resected specimen indicated that, while the muscularis mucosae layer was well preserved, the muscularis propria had disappeared in most areas of the diverticular wall, suggesting that it was a false or pseudodiverticulum. Histologically, suppurative inflammation was noted in the serosal surface of the duodenal diverticulum, probably being due to the peritonitis.

After surgery, minor bile leakage was noted from the drain placed in the right prerenal space. The leakage stopped soon; the postoperative course after that was uneventful and the patient was discharged from the hospital.

## Discussion

In the entire gastrointestinal tract, the duodenum ranks second to the colon as the most common site for the development of diverticula.[2] Although duodenal diverticula have been reported to occur in approximately 5%–10% of adults undergoing upper gastrointestinal radiography or endoscopy, perforated duodenal diverticulum is relatively uncommon, and a limited number of cases have been reported in the literature.[3–6] Some patients manifest certain complications, including hemorrhage, diverticulitis, pancreatitis, and biliary obstruction,[7,8] and 1%–2% of patients require surgical treatment for related complications.[3]

The clinical diagnosis of duodenal diverticula is generally difficult and incorrect, because there are no characteristic signs or symptoms, and the symptoms are

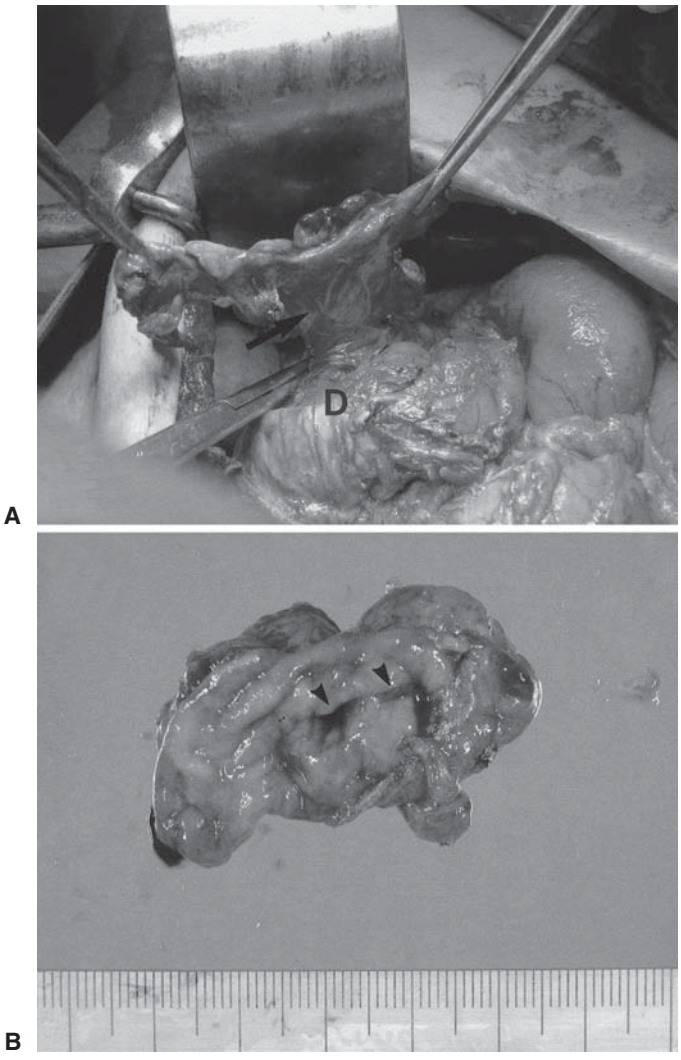


**Fig. 5.** **A** The perforated diverticulum (*arrow*) associated with the descending portion of the duodenum (*D*) was mobilized from the retroperitoneum. **B** The resected specimen, indicating the diverticulum, 42 × 23 mm in size, and two separate sites of perforation (*arrowheads*), identified at the distal portion of the diverticulum

vague and nonspecific. It has classically been reported that 1%–10% of duodenal diverticula are symptomatic with either vague chronic complaints or acute pain.[9] Juler et al.,[1] in reviewing perforated duodenal diverticulitis, found a 71.4% incidence of sudden or acute pain. The failure of correct diagnosis was partly due to the fact that the symptoms were sometimes nonspecific and partly that no peritoneal sign appeared and there was no free air on the plain abdominal X-ray film, because the perforation occurred into the retroperitoneal space.[1,3,10,11] The most common erroneous diagnoses in the cases involved in the review by Juler et al.[1] were cholecystitis, perforated viscus, and appendicitis. Another review of patients with perforated duodenal diverticulum indicated that perforated duodenal diverticulum was correctly diagnosed in only 13 of 101 cases,[3] i.e., only 13%. In most patients, the onset of the symptoms is acute, with abdominal pain localized to the right upper abdomen or epigastric area, and associated nausea and vomiting. Some patients present with chronic abdominal pain, anorexia, and general malaise, and these symptoms may have lasted as long as 1 month. The nature of symptoms may be insidious in patients retroperitoneal rupture of the duodenal diverticulum.

While the collection of contrast media in the diverticulum and the leakage after the upper gastrointestinal series was the key to the accurate preoperative diagnosis of perforated duodenal diverticulum in our patient, upper gastrointestinal series failed to be a useful diagnostic approach in the previous literature.[1,10–12] This may be due to the fact that there are cases of diverticula with narrow neck or the presence of a stone. One of the diagnostic clues is the presence of retroperitoneal free air.[13,14] Glasser et al.[13] mentioned the importance of the presence of retroperitoneal gas in the periduodenal space and in the upper pole of the right kidney, detected by plain abdominal X-ray. In contrast, Duarte et al.[3] reported that only 27% of the patients with perforated duodenal diverticulum showed retroperitoneal gas, and half of the patients had normal findings on plain abdominal X-ray film, suggesting that the diagnostic significance seems to be low.

Abdominal CT scanning has been reported to be a useful diagnostic tool for perforated duodenal diverticula,[15–17] because of its ability to detect small amounts of extraluminal gas, associated with its ability to clearly display the retroperitoneal anatomy.[18] In the present patient gas and fluid collection were noted in the anterior perirenal space. Because of its greater contrast resolution and tomographic nature, CT scan can demonstrate even a small amount of gas or fluid in the anterior perirenal space.[18] In the present patient, contrast media that had infused through the duodenal tube into the upper gastrointestinal tract resulted in accumulation in the diverticulum, and the leakage into the anterior perirenal space enabled us to confirm the presence of duodenal diverticulum associated with perforation. The abdominal CT scan after the infusion of contrast media into the upper gastrointestinal tract was quite useful for the diagnosis.

It has classically been described that surgical treatment is required for only 1%–2% of patients with duodenal diverticula.[19–21] Duarte et al.[3] mentioned in their review that special care should be taken to avoid injury to the distal common bile duct and Vater's papilla, because most duodenal diverticula arise in that area. In the present patient, because the perforated duodenal diverticulum was located in the lateral side of the descending portion of the duodenum, the pancreas

head and intrapancreatic portion of the common bile duct were next to the perforated duodenal diverticulum and, therefore, the common bile duct was identified during the mobilization of the diverticulum from the retroperitoneum. Common complications related to the repair of perforated duodenal diverticula have been reported to be duodenal fistula, intraabdominal abscess or sepsis-related complications, pancreatitis, and sustained wound infection.[3]

Patients successfully treated with conservative therapy alone have previously been reported.[1,6,22] However, one of these patients had a cholecystoduodenal fistula that initially mimicked a perforated duodenal diverticulum. Except for some specific patients of advanced age and/or with severe underlying medical problems for whom there is an extremely high risk with surgical intervention, surgery is definitely the first choice of treatment, once the diagnosis of perforated duodenal diverticulum is made.

In summary, while perforated duodenal diverticulum is uncommon, fluid collection and gas in the prerenal space on ultrasound and abdominal CT scan are the characteristic findings. The present case suggests that upper gastrointestinal series followed by a CT scan is useful for the preoperative diagnosis of perforated duodenal diverticulum.

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