

A Case of Gas-containing Liver Abscess Associated with Emphysematous Change in the Gallbladder

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ABSTRACT

We describe a 77-year-old man with diabetes mellitus who developed a large gas-containing pyogenic liver abscess after admission. Mild elevation of serum biliary enzyme levels suggested probable biliary trouble on admission. Ultrasonography and computed tomography showed a large abscess of the liver with gas formation and the presence of gas within the lumina of the gallbladder and biliary tract when the patient had fever, leukocytosis and evidence of hepato-renal dysfunction. These findings suggest that the large liver abscess may have developed as a result of emphysematous cholecystitis.

Key words: Gas-containing liver abscess, Emphysematous cholecystitis, Diabetes mellitus

The incidence of gas-containing pyogenic liver abscess has recently been increasing along with the widespread popularization of imaging modalities such as computed tomography (CT) and ultrasonography (US)^{7,10,11,13-15}. In this paper, we report a rare case of gas-containing liver abscess which appeared to have resulted from emphysematous cholecystitis, judging from the coexistence of the abscess with gas formation within the lumina of the gallbladder and biliary tract on CT and US.

CASE REPORT

A 77-year-old man with a 28-year history of diabetes mellitus was admitted to Kato Hospital on December 20, 1993, because of poor appetite. He had undergone a total gastrectomy with splenectomy for advanced gastric cancer at Shimane Medical University Hospital in December 1992, and two percutaneous transluminal coronary angioplasties followed by coronary aorta by-pass grafting (CABG) for myocardial infarction at the same hospital in June 1993. He had also been hospitalized with depression for a further 6 months after the CABG in the psychiatry ward of Shimane Medical University Hospital, where his serum transaminase and biliary enzyme levels had been mildly elevated and his diabetes had been well controlled with only diabetic diet. He had no past history of common bile duct stone with obstructive jaundice, and he had undergone neither duodenal papillotomy nor papilloplasty. His family history was unremarkable.

Physical examination on admission revealed the following: body height, 159 cm; body weight, 38

kg; body temperature, 36.6°C; pulse rate, 72/min; blood pressure, 110/70 mmHg. Laboratory data on admission are shown in Table 1. The biliary enzymes were mildly elevated. The fasting blood sugar (FBS) was mildly elevated and the HbA_{1C} level was also elevated. However, we followed his diabetes non-pharmacologically. The level of C-reactive protein (CRP) was increased, but the serum bilirubin and transaminase levels were within normal limits.

On admission, a plain abdominal film revealed no abnormal findings, and an upper gastrointestinal series showed no abnormal communication between the gastrointestinal and biliary tracts.

As the patient's appetite diminished progressively after admission, enteral nutrition with an elemental diet was started. On January 20, 1994, there was a sudden onset of chills and high fever followed by itching and jaundice, and laboratory data revealed abnormal liver function parameters (AST 72 IU/L, ALT 106 IU/L, ALP 962 IU/L, γ -GTP 218 IU/L and T-Bil 4.8 mg/dl) and renal dysfunction (BUN 106.8 mg/dl and creatinine 2.8 mg/dl), as shown in Table 1. The white blood cell count (WBC) was 14,000 /mm³, CRP level 20.8 mg/dl, and erythrocyte sedimentation rate (ESR) 65 mm/h. US showed a small amount of ascites, debris in the gallbladder and wall thickening of the gallbladder, but no abnormal findings in the liver itself. We suspected inflammation of the biliary tract, started intravenous hyperalimentation (IVH) and insulin therapy, and gave the patient a low dose of an antibiotic (CMZ, 1.0 g/day) for 6 days because of the presence of renal dysfunction. Although the fever disappeared and

Table 1. Laboratory Data

	On admission (Dec 20, 1993)	32nd hospital day (Jan 20, 1994)
Peripheral blood		
WBC (/mm ³)	6,900	14,000
RBC ($\times 10^4$ /mm ³)	426	368
Hb (g/dl)	13.6	11.7
Ht (%)	41.2	35.1
PLT ($\times 10^4$ /mm ³)	26.9	23.8
Electrolytes		
Na (mEq/L)	139	138
K (mEq/L)	4.0	6.0
Cl (mEq/L)	96	92
Urinalysis		
protein	(+)	(-)
glucose	(-)	(-)
occult blood	(-)	(-)
Blood chemistry		
T-Bil (mg/dl)	0.4	4.0
TP (g/dl)	7.2	6.3
Alb (g/dl)	3.7	3.1
AST (IU/L)	22	60
ALT (IU/L)	14	176
γ -GTP (IU/L)	94	324
ALP (IU/L)	406	1,045
BUN (mg/dl)	26.5	106.8
Crea (mg/dl)	1.5	2.8
FBS (mg/dl)	118	157
HbA _{1C} (%)	8.6	—
Serological findings		
CRP (mg/dl)	4.3	20.8
HBsAg	(-)	
HBsAb	(-)	
HCVAb (RIA II)	(-)	
ESR (mm/h)	—	65
AFP (ng/ml)	<1	2
CEA (ng/ml)	0.8	1.2
CA19-9 (U/ml)	14	63

renal function improved, liver dysfunction, leukocytosis and the elevated CRP level remained unchanged, and blood sugar was often over 200 mg/dl. Therefore, we administered a large dose of

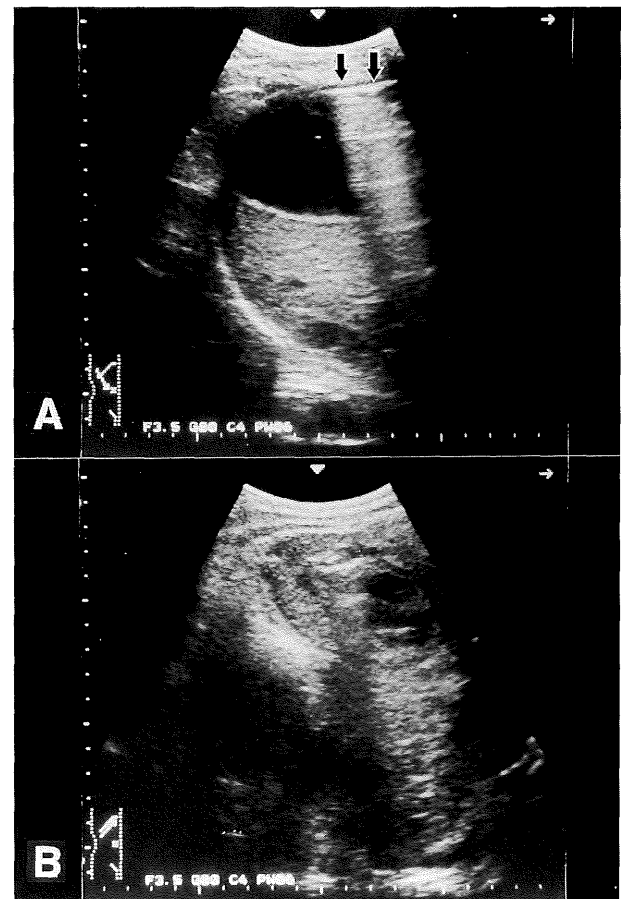


Fig. 1. A: US showing a large hypoechoic mass with a hyperechoic broad band (arrows) due to gas in the right hepatic lobe. **B:** US showing some hyperechoic bands arising from gas within the lumen of the gallbladder.

another broad-spectrum antibiotic (CPR, 4.0 g/day) starting on February 4, 1994.

US on February 7 showed a large hypoechoic mass with a smooth margin including a hyperechoic broad band arising from gas in the right lobe of the liver (Fig. 1. A), and a gallbladder with a thick wall and some hyperechoic bands within the lumen (Fig. 1. B).

An abdominal plain film taken in the upright position revealed an air-fluid level under the right hemidiaphragm (Fig. 2. A), and another one taken in the supine position showed a large oval gas shadow (Fig. 2. B).

CT demonstrated a gas-containing low-density mass measuring $10 \times 10 \times 5$ cm in the right hepatic lobe (Fig. 3. A), gas bubbles in the biliary tract and gas accumulation within the lumen of the gallbladder (Fig. 3. B).

US-guided needle aspiration from the abscess was performed on February 15, 1994, and about 170 ml of brownish-yellow pus was removed (Fig. 4). The pus, which had little smell, included a

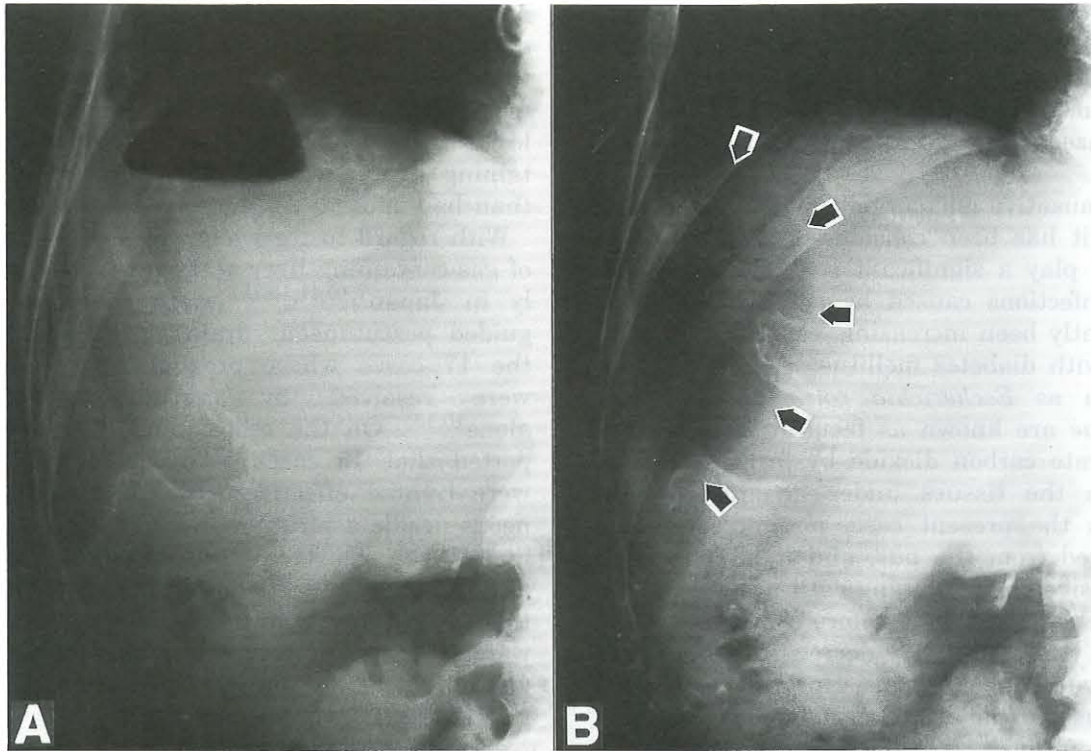


Fig. 2. A: Abdominal plain X-ray film taken in the upright position showing an air-fluid level in the right upper quadrant. **B:** Abdominal X-ray film taken in the supine position showing a large oval gas shadow (arrows).

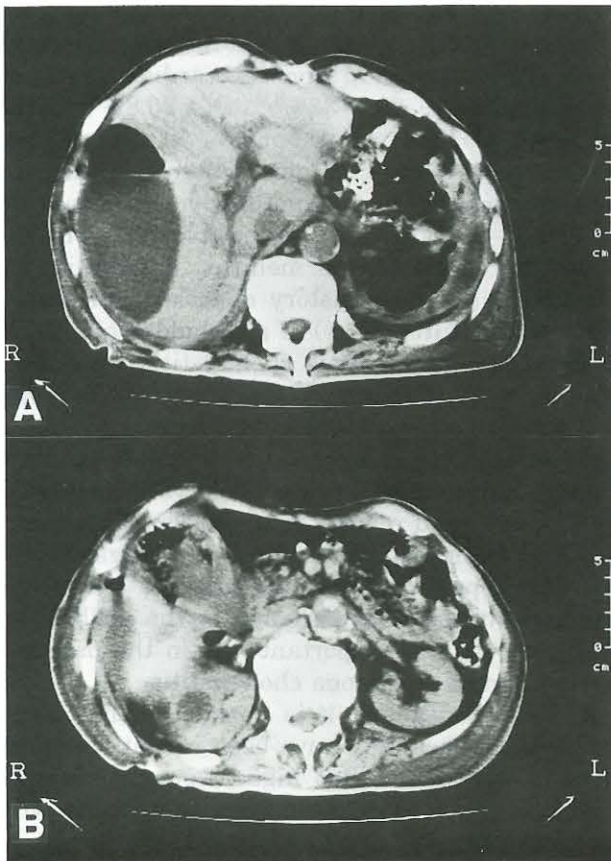


Fig. 3. A: CT showing a large gas-containing low-density mass. **B:** CT showing gas formation within the lumen of the gallbladder.



Fig. 4. Brownish-yellow pus aspirated from the gas-containing liver abscess.

large number of neutrophils and lymphocytes, but no microorganisms were isolated from it upon culture for aerobes, anaerobes and fungi.

The patient's appetite returned, his temperature and WBC returned to normal, and his CRP level decreased markedly following the aspiration and antibiotic therapy. However, he suffered an angina attack followed by congestive heart failure on February 21, 1994, and died six days later.

DISCUSSION

Although cases of gas-containing liver abscess seem to be rare, it has recently been reported

that 15% of all patients with liver abscess have gas detectable by CT⁶). This increase in incidence may be ascribed to the ability of CT and US to detect even a small amount of gas, which cannot be visualized by conventional plain X-ray examination.

As the causative microorganisms of gas-forming infection, it has been considered that anaerobic organisms play a significant role. However, gas-forming infections caused by aerobic organisms have recently been increasing, especially in aged patients with diabetes mellitus²). Aerobic organisms such as *Escherichia coli* and *Klebsiella pneumoniae* are known as facultative anaerobes and generate carbon dioxide by fermentation of glucose in the tissues under anaerobic conditions⁷). In the present case, no microorganism was isolated from the pus, and it is considered that intensive chemotherapy with a large dose of broad-spectrum antibiotic before aspiration of the pus might have effectively decreased the number of causative microorganisms. However, as the aspirated pus did not have an offensive odor, this abscess may not have been due to anaerobes.

In cases of gas-containing liver abscess reported in Japan up to now¹⁰), the mean age of the patients has been 63.2 years. The underlying conditions included diabetes mellitus (78%) and/or biliary tract diseases (33%). Thus, our present case was similar to many of the cases reported previously.

Interestingly, US and CT in this case also showed gas formation within the lumina of the gallbladder and biliary tract. The US findings were consistent with those of emphysematous cholecystitis described previously³), involving a band of reverberation in the gas-filled portion of the gallbladder with the usual signs of cholecystitis in the bile-filled portion when the gallbladder was partially full of gas. Gas-containing liver abscess associated with gas formation within the lumina of the gallbladder and biliary tract is very rare, and to our knowledge only two such cases have been reported previously^{10,11}). One case¹⁰) was a gas-containing liver abscess with gallstone, associated with gas formation within the lumina of the gallbladder and intrahepatic bile ducts, but not within or around the wall of the gallbladder. The other case¹¹) had multiple gas-containing liver abscesses and acute emphysematous cholecystitis which were confirmed at autopsy following percutaneous transhepatic internal/external biliary drainage. In our present case, although without gallstone, as in the first case above, US and CT detected gas only within the lumina of the gallbladder and intrahepatic bile duct. However, in our case the diagnosis of emphysematous cholecystitis was not confirmed, since autopsy could not be performed, but the absence of biliary enteric fistula, confirmed by an upper gastrointesti-

nal series, and the lack of a past history of duodenal papillotomy or papilloplasty suggested that this was a reasonable diagnosis. Furthermore, the persistent elevation of biliary enzyme levels after CABG suggested that the gas-containing liver abscess had resulted from, rather than had caused, emphysematous cholecystitis.

With regard to treatment, 20 (69%) of 29 cases of gas-containing liver abscess reported previously in Japan^{7,10,11,13,15}) were subjected to US-guided percutaneous drainage. Fifteen (88%) of the 17 cases whose prognoses were described were resolved by percutaneous drainage alone^{10,15}). On the other hand, it has been reported that 15 cases of pyogenic liver abscess were treated effectively by US-guided percutaneous needle aspiration and appropriate antibiotic therapy¹). Thirteen of the 15 patients improved after a single aspiration, and the others after further aspirations. Solitary abscesses in 10 patients were aspirated as completely as possible, with a volume of 100 to 200 ml. Our patient felt better after aspiration of 170 ml of the pus.

According to two comparative analyses of collected series of acute emphysematous cholecystitis with ordinary acute cholecystitis^{8,9}), emphysematous cholecystitis was much more common in males than in females. The mean age of the patients was 65.9 years⁸), and 28% of the patients did not have associated cholelithiasis^{8,9}). Diabetes mellitus and cardiovascular diseases such as hypertension and myocardial infarction were present in 29.2–38%^{8,9}) and 20.8%⁸) of the patients, respectively. About 10% of the patients had a past history of gastrectomy⁸). Gangrene and perforation of the gallbladder occurred in 74–94.7% and 12.3–21%, respectively^{8,9}). Our patient also had diabetes mellitus, myocardial infarction and a past history of total gastrectomy. Fifty-one cultures (71%) of gallbladder bile in 72 cases of emphysematous cholecystitis were positive, and *Clostridium*, *Klebsiella* or *Escherichia coli* was grown from 41.2%, 21.6% or 21.6% of the positive cultures, respectively⁸). Together with potential compromise of the cholecystic artery in gastrectomy and reports of emphysematous cholecystitis after hepatic arterial embolization^{4,12}) and cardiopulmonary resuscitation⁵), the above findings suggest that ischemia in the gallbladder wall may play an important role in the pathogenesis of emphysematous cholecystitis.

As described above, it is considered that facultative anaerobes may have been causative organisms in our case. When high fever and jaundice developed, US showed findings compatible with cholecystitis, although gas formation could not be detected. At that time no liver abscess existed yet. In addition to ischemia of the gallbladder, high blood sugar seems to be related to the development of emphysematous cholecystitis^{7,8}). In

facultative anaerobic infection, the more glucose, the greater the generation of gas. Thus it may be reasonable to consider that the increase in the blood sugar level due to IVH induced massive gas formation in the gallbladder followed by a large gas-containing liver abscess in the present case.

Gas-containing liver abscess and acute emphysematous cholecystitis seem to have some common factors in their pathogenetic background, as described above. Since 33% of patients with gas-containing liver abscess had biliary tract diseases¹⁰⁾, physicians should be aware that gas-containing liver abscess may sometimes be complicated by emphysematous cholecystitis.

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