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【 CASE REPORT 】

Cholecystitis and Cholangitis during Continuous Renal Replacement Therapy in a Patient with Retroperitoneal Hemorrhage Requiring Large Amounts of Contrast Medium for the Assessment and Intervention

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Abstract:

Intravenous use of contrast medium (CM), which may cause kidney dysfunction, is admissible for hemodialysis patients because of the efficient removal by hemodialysis. We herein report a 61-year-old woman on hemodialysis who suffered from cholecystitis and cholangitis after large-volume CM administration during continuous renal replacement therapy. After catheter ablation, she developed life-threatening retroperitoneal hemorrhage, which led to the use of 500 mL CM for 5 consecutive days. It should be kept in mind that excessive vicarious CM excretion in the biliary system may become a predisposing factor of cholecystitis and cholangitis in patients who frequently undergo radiological interventions and imaging.

Key words: complication, hemodialysis, vicarious contrast medium excretion, radiological intervention, catheter intervention

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Introduction

Contrast medium (CM) is widely used during computed tomography (CT) and therapeutical interventions but may lead to kidney dysfunction. For hemodialysis patients, the intravenous use of CM is permissible, when necessary, as CM can be efficiently removed from the blood by hemodialysis. However, rare comorbidities induced by CM should be kept in mind, even in such patients.

We herein report a case of cholecystitis, cholangitis, and mild (when present) pancreatitis following excessive vicarious contrast media excretion (VCME) via the liver in the bile during continuous renal replacement therapy (CRRT) after catheter ablation complicated with retroperitoneal hemorrhage.

Case Report

A 61-year-old woman on maintenance hemodialysis who had no marked medical history related to biliary tract disorders, including cholelithiasis, cholecystitis, and choledocholithiasis (Fig. 1), received cryoablation for paroxysmal atrial fibrillation. After the procedure, she developed hypotension and transfusion-dependent anemia due to retroperitoneal hemorrhage 122 mm×172 mm×113 mm in diameter requiring 5 evaluations by contrast CT and 3 emergent interventional radiology procedures (Fig. 2). CRRT was performed instead of hemodialysis while she was in a hemodynamically unstable condition. Although the bleeding was brought under control during intubation from postoperative day (POD) 3 to 8, cholecystitis and cholangitis became increasingly visible as serious issues; plain CT on POD 1 depicted obvious gallbladder and common bile duct opacification without any symptoms (Fig. 3A), followed by biliary en-

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zyme elevations. On POD 4, the unenhanced liver attenuation value increased from 60 Hounsfield units (HU) at baseline to 90.5 HU (Fig. 3B). Although the onset of symptoms, such as abdominal pain or nausea could not be evaluated during the tracheal intubation, the patient complained of abdominal discomfort soon after extubation on POD 8, with a fever, jaundice, and leukocytosis. Plain CT on POD 9 and ultrasonography on POD 13 revealed intrahepatic and extrahepatic biliary dilation (Fig. 4A, 4B), and contrast CT on POD 13 demonstrated a distended gallbladder with contrast-enhanced thickened wall (Fig. 4C), which led to the diagnosis of cholecystitis and cholangitis with moderate severity (1, 2). Serum pancreatic amylase level was elevated above 1,000 U/L on POD 13, but contrast CT demonstrated neither obvious swelling of the pancreas nor peripancreatic inflammation findings (Fig. 5). While these results did not strongly suggest the presence of typical pancreatitis, the incessant abdominal pain and high level of ascitic amylase on POD 15 (Table) supported the possible presence of mild pancreatitis (3).

All of these symptoms and laboratory data gradually im-

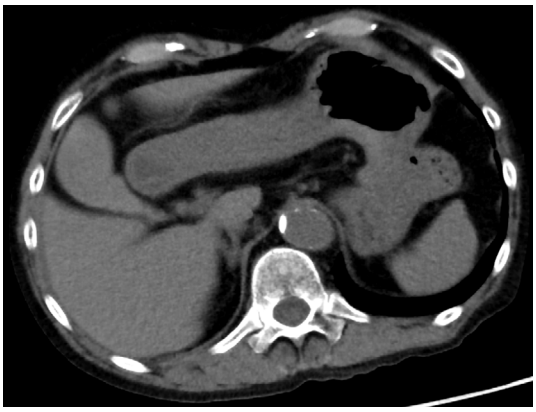

Figure 1. **The abdominal plain CT finding on POD 0. As a baseline state, the patient had no findings of asymptomatic gallstones that could be detected by CT. Ultrasonography and magnetic resonance image evaluations had not been conducted before admission.**

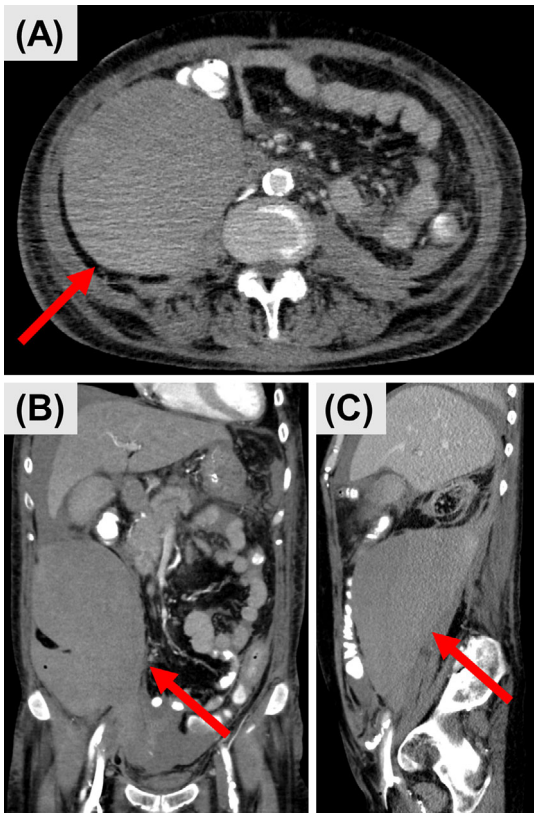

Figure 2. **The CT findings of retroperitoneal hematoma on POD 4. Axial (A), coronal (B), and sagittal (C) CT images on POD 4. The retroperitoneal hematoma was detected from POD 1, and the hematoma gradually expanded over four days after the ablation procedure. The CT findings on POD 4 revealed the hematoma (red arrows) of 122 mm×172 mm×113 mm in diameter, and thus the hematoma reached its maximum size on POD 4.**

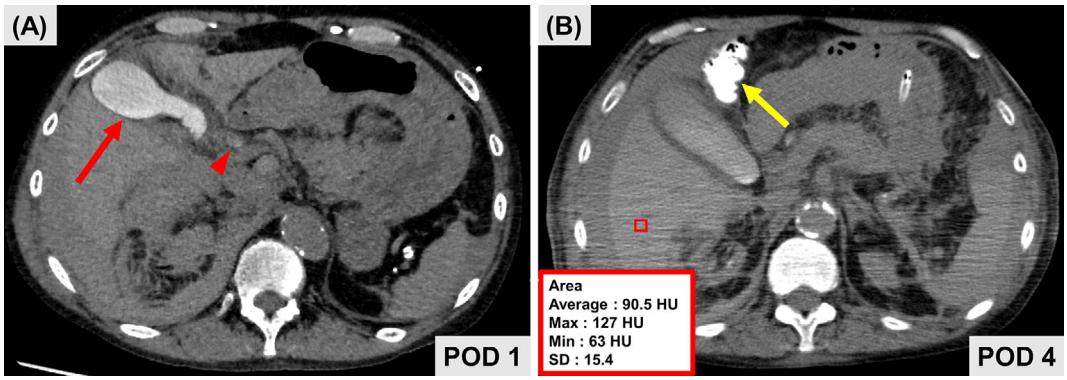

Figure 3. **The CT findings of vicarious contrast medium excretion. (A) Plain CT on the first postoperative day (POD 1) demonstrated the gallbladder (red arrow) and bile duct (red arrowhead) opacification, although the patient did not have any symptoms. (B) The unenhanced liver attenuation value showed 90.5 HU on average for the area (red box). The maximum (Max) and minimum (Min) HU values of the area are also shown. Active extravasation of CM into the transverse colon was shown (yellow arrow).**

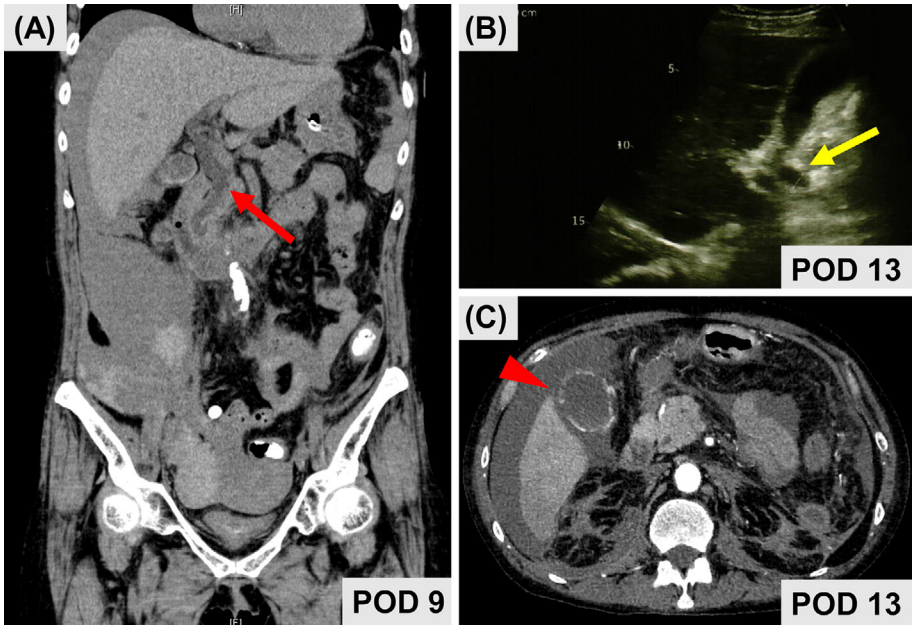

Figure 4. **The CT and ultrasonography findings on PODs 9 and 13. (A) Plain CT image on POD 9. (B) Ultrasonography of common bile duct on POD 13. (C) Contrast CT image on POD 13. The common biliary duct (red arrow) was dilated to 14 mm on POD 9, and ultrasonography on POD 13 detected the same finding (yellow arrow), with the diameter of the common biliary duct measuring 10 mm. In addition, contrast CT on POD 13 indicated cholecystitis with fully circumferentially enhanced gallbladder wall thickening (red arrowhead) compared to POD 4.**

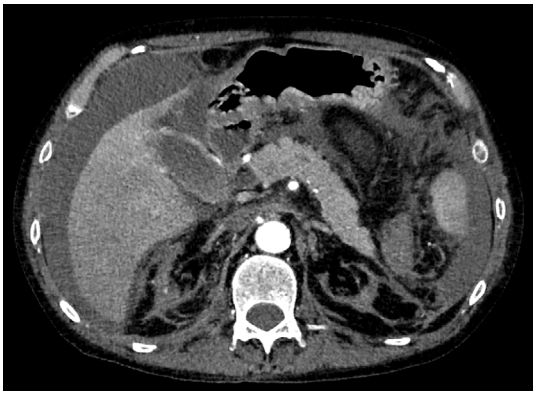

Figure 5. **The contrast CT findings on POD 13. Contrast CT showed no obvious swelling of the pancreas or peripancreatic inflammation.**

Table. **Findings from the Peritoneal Fluid Sample on POD 15.**

Peritoneal fluid sample	
Total protein	3.2 g/dL
Albumin	2 g/dL
Lactate dehydrogenase	4,119 U/L
Total bilirubin	11 mg/dL
Direct bilirubin	2 mg/dL
Triglyceride	42 mg/dL
Amylase	606 U/L

POD: postoperative day

proved with conservative management using antibiotics within a month. The patient was discharged on POD 46 (Fig. 6).

Discussion

Ordinal hemodialysis eliminates 70-80% of CM within 4 hours (4), whereas 1-2% of CM is vicariously excreted through hepatocytes, even in patients with a normal renal function (5). VCME typically occurs after injecting CM without causing any noticeable symptoms, but the current case demonstrated that the prolonged stagnation of CM in the biliary system could represent a predisposing factor for inflammation of the gallbladder, bile duct, and pancreas. The physical findings, including the incessant abdominal pain, fever, and jaundice, as well as the laboratory data and ultrasonography and CT findings met the criteria of acute cholecystitis and cholangitis according to the Tokyo Guidelines 2018 (1, 2). Acute pancreatitis was also diagnosed based on the following criteria: abdominal pain together with the elevation of the serum pancreatic amylase concentration (3); however, the CT findings did not strongly suggest the presence of strong pancreatic inflammation. Thus, we considered that even if the patient developed pancreatitis, the disease severity would be mild.

We suspected three potential underlying causes for the CM accumulation: the method of renal replacement, the contrast volume, and the type of CM. First, because the blood flow rate, dialysis flow rate, and size of the dialyzer are lower in CRRT than in hemodialysis, the removal effi-

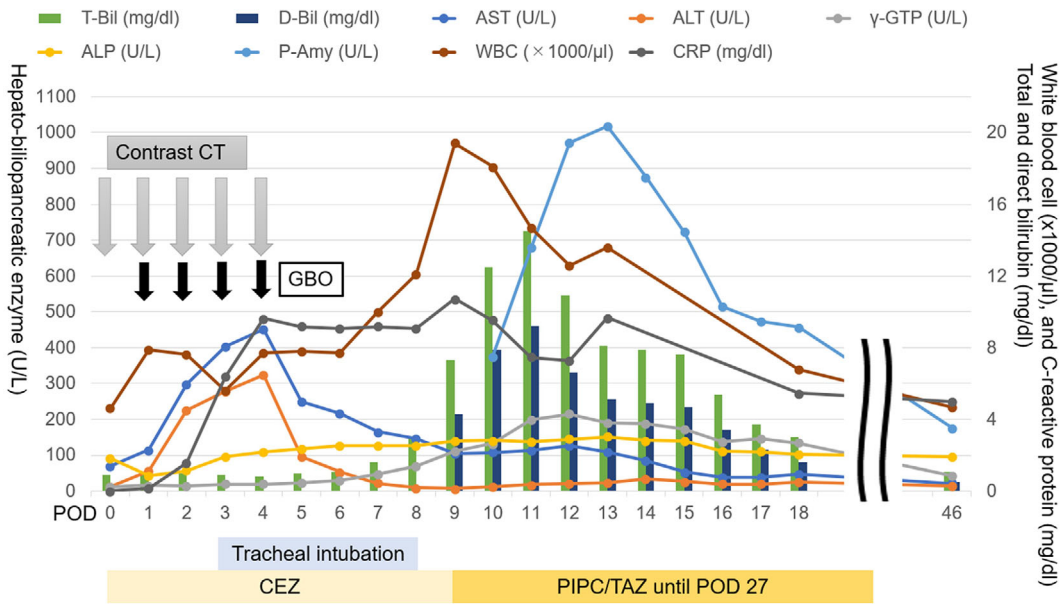

Figure 6. **The clinical course of the patient. Repeated contrast-enhanced CT (gray arrows) evaluations were performed for the retroperitoneal hematoma. We noted gallbladder opacification (GBO) (black arrows) for five consecutive days. The white blood cell count and bilirubin and γ-GTP levels were elevated from POD 6, followed by the elevation of pancreatic amylase levels. These data gradually improved with conservative therapy of antibiotics, and the patient was discharged on POD 46. T-Bil: total bilirubin, D-Bil: direct bilirubin, AST: aspartate aminotransferase, ALT: alanine aminotransferase, γ-GTP: gamma-glutamyl transpeptidase, ALP: alkaline phosphatase, P-Amy: pancreatic amylase, WBC: white blood cell, CRP: C-reactive protein, CEZ: cefazolin, PIPC/TAZ: piperacillin/tazobactam**

ciency of CM by CRRT in our patient was deteriorated. Second, the total amount of CM administered (300 mL iohexol, 200 mL iomeprol, and a small amount of iopamidol used in interventional radiology procedures) exceeded 500 mL for 5 consecutive days. According to a previous report, the administered volume of CM can be a significant factor for gallbladder opacification (6). However, Ku et al. reported that the contrast volume was not an independent predictor of gallbladder opacification, although their administered amount of CM was 100 mL at most, which was 20% of that in the present case (7). Accordingly, the CM volume might have influenced the hepatobiliary excretion and subsequent inflammation in the present case. Finally, the type of CM may also be an influential determinant of gallbladder opacification. Iohexol and iomeprol were mainly used in the present case, and the former shows a higher gallbladder opacification rate than other products (6), while the latter's effect has not been reported. However, iomeprol has a lower osmolality and higher protein binding capacity than iohexol, making it more preferentially excreted into the bile (8). These three factors likely led to the accumulation of CM in the biliary system, which could thus induce the inflammation of these organs.

Long periods of fasting or a critically ill status with tracheal intubation may contribute to the development of acute acalculous cholecystitis and cholangitis, as these conditions inhibit the release of cholecystokinin and prevent relaxation of the sphincter of Oddi, which results in intrabiliary pressure elevation (9). However, the further burden of a large volume CM to the biliary system would add insult to injury. In the present case, high-osmolality CM (500-700 mOsm/kg) likely promoted the inflammation of the gallbladder, bile duct and possibly the pancreas (10). A previous report guaranteed the safety of nonionic CM administration between 40-225 mL in cases of maintenance dialysis without additional postprocedural dialysis (11); however, no data have clarified the acceptable amount of CM during CRRT. The present case demonstrates the need for the careful administration of CM from the perspective of excessive VCME, and VCME-related cholecystitis and cholangitis (and likely pancreatitis as well) should be kept in mind in patients with CRRT who require frequent radiological interventions and imaging tests.

Conclusion

Large-volume CM administration can exacerbate or even provoke cholecystitis and cholangitis through vicarious CM excretion in renal dysfunction patients receiving CRRT.

The authors state that they have no Conflict of Interest (COI).

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