Acute portal vein thrombosis after hepatectomy in a patient with hepatolithiasis
A case report and review of the literature
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Abstract
Rationale: Portal vein thrombosis is defined as any thrombosis that develops in the portal vein system. It is considered a very rare and extremely lethal complication of hepatopancreatobiliary surgery.

Patient concerns: Acute portal vein thrombosis after hepatectomy is considered as a dangerous complication after hepatectomy. It is easy to ignore the symptom of acute portal vein thrombosis. Once the appropriate time of treatment is past, it would lead to patients’ death.

Diagnose: Acute portal vein thrombosis after hepatectomy in a patient with hepatolithiasis

Interventions: We consider anticoagulation therapy and percutaneous transhepatic portal vein puncture and thrombectomy once the diagnosis of acute portal vein thrombosis is confirmed.

Outcomes: The patient’s liver function continued to deteriorate, eventually resulting in death.

Lessons: Acute portal vein thrombosis after hepatectomy is difficult to diagnose. The management of acute portal vein thrombosis remains controversial according to its severity, location or time of discovering.

Abbreviations: POD = postoperative day, PVT = portal vein thrombosis.

Keywords: acute portal vein thrombosis, hepatectomy, hepatolithiasis

1. Introduction
Portal vein thrombosis (PVT) is defined as any thrombosis that develops in the portal vein system. It is usually recognized in patients with cavernomatous transformation of the portal vein with portal hypertension. Postoperative PVT is considered a very rare and extremely lethal complication of hepatopancreatobiliary surgery. Most reported cases have occurred in patients undergoing liver transplantation, splenectomy, or pancreaticoduodenectomy. Risk factors include liver cirrhosis, chronic hepatitis, splenomegaly, and the Pringle maneuver, and portal hypertension. We herein report a case of acute postoperative PVT in a patient with hepatolithiasis. Compared with the published literature, our case is unique because no similar reports can be found, previously established risk factors could not explain the reason for the occurrence of PVT, and the cause of the patient’s death despite the performance of all necessary treatments remains unknown.

2. Case report
In November 2015, a 44-year-old man was admitted to the outpatient clinic of our hospital with a 1-month history of fever, abdominal pain, and jaundice. He reported having undergone cholecystectomy in 1993 and exploratory surgery of the common bile duct in 1995 and 2010. The patient denied any history of chronic liver disease. He did not take any special dietary or herbal agents and did not drink alcohol. Measurement of serologic markers and an ultrasonographic examination were negative for viral hepatitis, Budd-Chiari syndrome, and autoimmune hepatitis. A preoperative liver test, routine blood test, coagulation function test, and alpha-fetoprotein measurement showed no abnormalities. Abdominal ultrasonography and magnetic resonance cholangiopancreatography showed calculi in the main and left hepatic bile ducts, and the left lateral lobe was atrophic. No sign of hepatic PVT was detected by either ultrasound or magnetic resonance imaging (Fig. 1). Common bile duct exploration and left lateral lobe heptectomy was then performed. The Pringle maneuver was not used during the surgery, and no obvious blood loss occurred during the heptectomy.

The postoperative course was uneventful with the exception of mild abdominal pain in the first 5 days after the surgery. On the sixth day, however, the patient showed obvious jaundice. Ultrasonography showed PVT of the main portal vein. Anticoagulation therapy using intravenous heparin at 10,000 U/day was administered. Twenty-four hours later, a coagulation disorder...
and obvious signs of bleeding were detected. After a discussion with clinicians from multiple disciplines, plasmapheresis with subsequent percutaneous transhepatic portal vein puncture and thrombectomy was performed. After this treatment, the portal vein showed a small blood flow signal. However, the liver function continued to deteriorate. One day later, the patient died. All blood test results are shown in Figure 2. After communication with the patient’s daughter, we received consent for publication of this case.

### 3. Discussion

Postoperative PVT is a very rare complication. Most reports regarding PVT have focused on liver transplantation or pancreaticoduodenectomy.[3,4] In the past 2 years, PVT has been considered to be a complication after hepatectomy, and several large-scale retrospective studies have confirmed this.[8,9] The reported prevalence of PVT after hepatectomy ranges from 2.1% to 9.0%, and the risk factors for portal thrombosis include the duration of the Pringle maneuver during the operation.[9]

![Figure 1. Imaging examination. (A, B) Preoperative magnetic resonance imaging showed no sign of portal vein thrombosis. Calculi were present in the main and left hepatic bile ducts. (C) Preoperative ultrasonography showed no signs of portal vein thrombosis. (D) Ultrasonography showed thrombosis in the main portal vein and left portal vein. The direction of flow in the portal vein was countercurrent (shown by blue color in Doppler ultrasonography).](image1)

![Figure 2. Postoperative blood test results. (A) Hemoglobin level. (B) International normalized ratio. (C, D) Alanine aminotransferase (ALT), aspartate aminotransferase (AST), and bilirubin levels. ALT = alanine aminotransferase, AST = aspartate aminotransferase.](image2)
hepatectomy. Anticoagulation therapy or thrombolytic treatment is the most common treatment for postoperative PVT. In their study, they developed a new surgical technique of major hepatectomy to straighten the portal vein. By anchoring the posterior wall of the portal vein and reduce the incidence of acute PVT after hepatectomy.

However, it seems to us that early prevention should be strongly recommended that if PVT detected on postoperative day 5 or earlier after initial hepatectomy, urgent surgery such as surgical thrombectomy would be the first choice; if PVT is detected on postoperative day 6 or later, immediate anticoagulation therapy is the first choice of the treatment of PVT.

We reviewed the published English-language literature data on this complication and the results are shown in Table 1. In their study, they developed a new surgical procedure by which to straighten the portal vein. By anchoring the posterior wall of the portal vein and reduce the incidence of acute PVT after hepatectomy.

We have not found an adequate explanation for the acute PVT in this patient. However, more data would be needed to confirm our hypothesis.

Table 1

| No. | Literature           | Age (years) | Usage of prophylactic anticoagulation | Associated liver disease | Location of PVT | Treatment technique and response rate |
|-----|----------------------|-------------|--------------------------------------|--------------------------|-----------------|--------------------------------------|
| 1   | Yoshiya et al[9]     | 19/208      | No                                   | Early                   | 0/19            | 7/19/11/9/0                        |
| 2   | Kuboki et al[8]      | 25/193      | No                                   | Early                   | 12/25           | 12/14/2/0                          |
| 3   | Jinbo and Graue[10]  | 77/74       | Yes                                  | Early                   | 1/0             | 0/1/1/0                            |
| 4   | Janssen et al[11]    | 172         | No                                   | Early                   | 0/121           | 1/0/44/2/0                        |
| 5   | Amitano et al[12]    | 121         | No                                   | Early                   | 0/121           | 4/4/0/2/0                         |
| 6   | Hongwe[13]           | 10/90       | No                                   | Early                   | 10/10           | 0/90/0/90/0                       |
| 7   | Kawarkar et al[14]   | 3/37        | No                                   | Early                   | 37/37           | 37/37/0/37/0                      |
| 8   | Lai et al[15]        | 31/148      | No                                   | Early                   | 31/31           | 31/31/31/31/0                     |

Anti-coag = anticoagulation therapy, Lytic = thrombolytic therapy, MPV = main portal vein, PPV = peripheral portal vein, Surg = surgical thrombectomy.

The specific surgical procedure was not mentioned in the study.
has shown an abnormal change in liver function or has developed abdominal pain after hepatectomy, PVT should be considered. At this point, aggressive Doppler ultrasonography and D-dimer or fibrin degradation product measurement should be performed to rule out PVT. If PVT is detected in the early postoperative period and the patient's coagulation function has not yet deteriorated, surgical thrombectomy or endovascular thrombectomy should be performed. Once the liver function has deteriorated, treatment of acute PVT becomes limited and the risk of mortality greatly increases.

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