Severe Mesenteric Venous Thrombosis After Laparoscopic Cholecystectomy

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ABSTRACT

Portomesenteric venous thrombosis is a rare complication after laparoscopic cholecystectomy. Sufficient management is important for prevention of bowel infarction. We present a severe case of portomesenteric venous thrombosis. Partial thrombosis of the central portal vein, complete thrombosis of the left portal vein and the superior mesenteric vein, as well as venous stasis of the small bowel and the ascending and transverse colon were seen on computed tomography angiography. After surgical thrombectomy and catheter-directed venous thrombolysis, the patient developed rethrombosis of the superior mesenteric vein with an additional thrombosis of the right liver artery. Relaparotomy and a further thrombectomy were performed. Bowel infarction was prevented, and on postoperative day 19, the patient was discharged in good condition. In this case of severe portomesenteric venous thrombosis, we found no thrombophilic disorders and 6 months of anticoagulation were recommended.

Key Words: Laparoscopic cholecystectomy, Portomesenteric venous thrombosis, Risk factors.

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INTRODUCTION

Portomesenteric vein thrombosis (PMT) is a rare complication after laparoscopic cholecystectomy (LCE). Reduced drainage of the portal vein (PV) in trauma, preexisting conditions (eg, liver cirrhosis), the pressure of pneumoperitoneum or hypercoagulable conditions (abdominal infection, inflammation, obesity), malignant neoplasm or oral contraceptive use, and other thrombophilic disorders (eg, factor V Leiden mutation, activated protein C resistance, prothrombin-complex mutation) are reported to be possible reasons for the development of a PMT **(Table 1).**[1–3] Even if this severe disease is rare, surgeons need to know how to treat this complication because LCE is currently a standard procedure for symptomatic gallbladder disease. Only 4 cases of PMT have been described previously in the literature. In all cases, PMT was managed by anticoagulation or a combination of anticoagulation with local thrombolysis.[1,4–6]

Adequate management of PMT is important to ensure good patient outcome. Here, we report a case of a fulminant life-threatening PMT and its clinical management.

CASE DESCRIPTION

A 34-year-old woman underwent LCE due to symptomatic acute gallbladder inflammation. She had experienced recurrent epigastric abdominal pain for 2 weeks. On admission, the patient presented with marked epigastric tenderness, mild elevation of liver enzymes, and the ultrasonographic findings of acute cholecystitis; preoperatively, no portal venous thrombosis and no liver or biliary tract abnormalities were detected. LCE was performed under general anesthesia. The first step of the operation was the creation of a pneumoperitoneum by transumbilical incision and dissection to the peritoneum with insertion of a trocar and an insufflation of carbon dioxide with a pressure of 10 mm Hg. After the insertion of the camera, we inspected the

Table 1.
Hereditary, Acquired, and Acute Factors for Development of PMT

Hereditary Factors	Acquired Factors	Acute Triggers
Factor V Leiden mutation	Antiphospholipid syndrome	Pneumoperitoneum
APC resistance	Adipositas	Inflammation
Prothrombin gene mutation	Oral contraceptive use	Abdominal infection
	Liver cirrhosis	Dehydration
	Autoimmune disease	
	Malignant neoplasm	
	Ethanol abuse	
	Nicotine abuse	
	Pregnancy	
	Pancreatitis	
	Portal hypertension	

Abbreviations: APC, activated protein C; PMT, portomesenteric vein thrombosis.
Compiled from data from Dan et al, James et al, and Sogaard et al.[1–3].

intraperitoneal cavity and did not detect any adhesions. Then we placed 3 other ports and began the preparation of the Calot triangle using the grasper and hook diathermy. The "critical view of safety" approach was used to prevent any manipulation of the porta hepatis. We did not detect any significant periportal inflammation or lymphadenopathy. After dissection of the important structures, clips were placed around the cystic artery and duct, which were cut with the scissors. The intraoperative anatomy was unremarkable, so in absence of cholestasis, no cholangiography was performed. The gall bladder was then dissected off the liver and a bag was used to remove it. Then we removed the ports, and the pneumoperitoneum, the peritoneum, and skin were closed. The procedure took 74 minutes total. A thrombosis prophylaxis with low-molecular heparin was used postoperatively for the length of hospital stay. After 2 days, the patient was discharged in good condition. Pathohistological examination of the specimen showed chronic inflammation of the gallbladder without any evidence of malignancy.

On postoperative day 5, the patient presented with strong diffuse abdominal pain, nausea, and vomiting. In the emergency department, a blood analysis was performed, which showed leucocytosis of 20.3 gigaparticles/L, C-reactive protein of 43.8 mg/L, alanine aminotransferase of 1.82 microkatals (μkat)/L (normal $<$0.6 μkat/L), and aspartate aminotransferase of 0.9 μkat/L (normal $<$0.6 μkat/L). A contrast-enhanced abdominal computed tomographic (CT) scan to verify the symptoms was initiated. CT demonstrated partial thrombosis of the central and left PV and complete thrombosis of the superior mesenteric vein as well as venous stasis of the small bowel, ascending colon, and transverse colon **(Figures 1A and 1B).** Due to the clinical and paraclinical findings, open laparotomy was performed. The small bowel and colon showed early signs of ischemia with marked wall thickening. During the laparotomy, embolectomy of the superior mesenteric vein and PV was performed. After venous embolectomy, sufficient drainage of the bowel was seen, and no bowel resection was necessary due to a complete resolution of the ischemia. The intraoperative thromboelastometry showed normal results. Additionally, a catheter for local

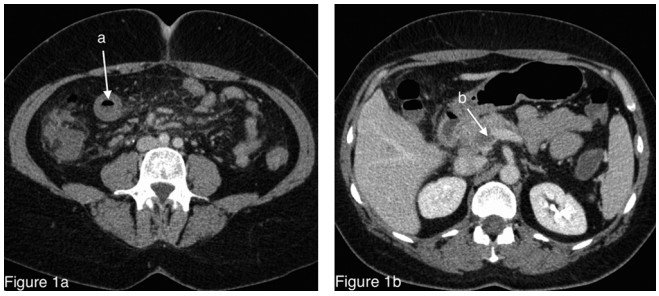

Figure 1. Abdominal CT scan of a 34-year-old female presenting with severe abdominal pain, nausea, and vomiting 5 days after laparoscopic cholecystectomy. **A.** Bowel wall thickening (arrow a) in contrast-enhanced axial CT scan is shown. **B.** Thrombosis of the central portal vein (arrow b) in the venous phase is shown.

lysis via the ileocolic vein was placed into the portomesenteric system and urokinase (10 000 international units [IU]/h) was administered. In addition, systemic therapeutic anticoagulation with continuous danaparoid infusion (150–400 IU/h) was conducted until the exclusion of a thrombosis induced by heparin-induced thrombocytopenia. On postoperative day 1, the patient developed highly elevated liver enzymes (alanine aminotransferase 33 μkat/L, aspartate aminotransferase 44 μkat/L). Again, CT angiography was ordered, and it showed rethrombosis of the central, right, and left PV; the superior mesenteric vein; and a thrombosis of the right liver artery with multiple liver infarctions **(Figures 2A and 2B)** in spite of the continuous local lysis and the systemic anticoagulation. The patient underwent relaparotomy with thrombectomy of the right liver artery and rethrombectomy of the portal venous system. Follow-up on day 3 after the second relaparotomy with contrast-enhanced ultrasonography showed good arterial liver perfusion and mildly reduced flow of the portal vein (16 cm/s). The liver enzymes rapidly decreased and the lysis catheter was removed via a small laparotomy after 6 days of local lysis with 10 000 IU/h urokinase. Afterward, recovery was very fast and the patient was transferred from intensive care unit to the ward. We observed an elevated amount of ascites (≤1150 mL/d), which was treated with diuretics, and after 6 days, the abdominal drains could be removed. Total hospital stay was 19 days, and the patient was discharged in good condition.

Our patient had no medical history of diabetes, autoimmune disease, cholestasis, prior hepatitis, or ethanol abuse. Further investigations for thrombophilia were negative. The coagulation factors II, X, and VIII were within normal ranges. Also, activated protein C resistance, factor V deficiency, mutation of the prothrombin gene, and antiphospholipid antibodies were negative. Our patient had a history of contraceptive use, but no history of smoking. Angiologists recommended a 6-month course of anticoagulation with rivaroxaban 7.5 mg to prevent rethrombosis of the portomesenteric system. A further duplex ultrasonogram before discharge showed regular arterial and portal liver perfusion, and the patient was asymptomatic. In the absence of thrombophilic disorders, inflammation of the gallbladder and pneumoperitoneum seemed to be responsible for this severe case of PMT.

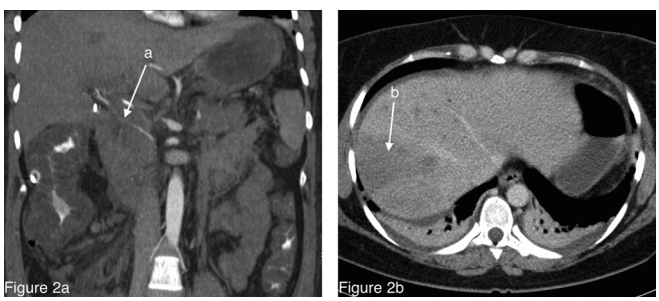

Figure 2. CT scan on postoperative day 1 (patient developed highly elevated liver enzymes [alanine aminotransferase 33 μkat/L, aspartate aminotransferase 44 μkat/L]). **A.** CT angiography, coronal reconstruction demonstrating thrombosis of the right liver artery (arrow a). **B.** Portal-venous phase showing liver infarction in segments 7/8 (arrow b).

DISCUSSION

PMT is a rare complication after laparoscopic surgeries such as cholecystectomy, appendectomy, colectomy, Nissen fundoplication, Roux-en-Y gastric bypass, or sleeve gastrectomy.[2,7]

Only 4 cases of PMT after LCE have been described in the literature.[1,4–6] An overview of the cases is given in Table 1. Two further cases in pediatric surgery after LCE in combination with splenectomy in children with hemolytic anemia have been described.[8,9] The development of thrombosis seems to be multifactorial with some specific considerations regarding laparoscopic surgery.[2,7] It is widely accepted that increased intra-abdominal pressure due to pneumoperitoneum can trigger PMT.[4] Several experimental and clinical studies showed that hepatic microcirculation, portal venous blood flow, and renal blood flow are decreased with increasing intra-abdominal pressure.[6,10–13] Increased intra-abdominal pressure leads to a decrease in mesenteric and portal venous blood flow via direct pressure-induced compression.[2] Additionally, insufflation of carbon dioxide has been shown to cause a more substantial decrease in venous flow than insufflation of other gases has.[2,14,15] Transperitoneal diffusion of carbon dioxide into circulation can cause hypercapnia, which has been implicated in decreasing splanchnic blood flow related to mesenteric vasoconstriction.[2,16] In this case, we used a standard insufflation pressure of 10 mm Hg (carbon dioxide) and a head-up position. Pressure >12 mm Hg in combination with the head-up position should be avoided during laparoscopic surgery because of possible compromise in intra-abdominal blood flow.[11] Furthermore, laparoscopy can trigger PMT in the presence of several risk factors. Predominant risk factors are prothrombotic disorders, followed by abdominal inflammation, malignancies, and abdominal infection.[1,3] Choi et al[17] reported an incidence of 8.3% (6 of 72 patients) of portal vein thrombosis in patients with acute cholecystitis. Portal vein thrombosis may have been the result of inflammation

or infection reaching the cystic vein. There can be a connection between the cystic vein and the hepatic sinusoid or a connection between the cystic and portal veins, and the infection can be spread directly.[17] Extension to mesenteric venous arches carries a high risk of intestinal infarction, with a reported mortality rate ≤50%.[18] There is also a correlation between oral contraceptives and portal venous thrombosis, depending on the duration and the agent. Only 1.2% of thrombosis occurring in women using oral contraception affected the portal venous system.[19] Pregnancy can also be a risk factor for portal venous thrombosis. An overview of risk factors is given in Table 1.

In our case, risk factors for PMT were the presence of gallbladder inflammation, oral contraceptive use, and laparoscopic intervention (LCE). In other cases of PMT after LCE, association with prothrombotic disorders was described. Preventza et al[6] reported a case of PMT associated with an elevation of the immunoglobulin G anticardiolipin antibody. Gul et al[4] reported about a patient with a heterozygous form of factor II (prothrombin) G20210A mutation. An exotic case of dengue viral infection–associated PMT after LCE was described by Dan et al.[1] Dengue viral infection may be responsible for the downregulation of thrombomodulin–thrombin–protein C complex formation reducing activated protein C, activating the link between coagulation-inflammation pathways or autoimmunity against endothelial cells, but the most probable correlation between infection and thrombosis was dehydration as a major risk factor of thrombosis.[1] Other prothrombotic disorders are the factor V Leiden mutation, antithrombin III deficiency, and proteins C and S deficiencies.[2] In our case, coagulation studies including fibrinogen, antithrombin III deficiency, protein C, protein S, plasminogen, anticardiolipin antibodies, activated protein C resistance, factor V Leiden, and factors X and VIII were negative.

Clinical presentation of PMT is varying widely. There is a broad range from asymptomatic cases to bowel infarction, and the diagnosis of a PMT is often delayed. Patients may initially present with nonspecific abdominal pain, nausea, vomiting, or diarrhea; other findings may include anorexia, colicky pain, or gastrointestinal bleeding.[2] In our patient, severe abdominal pain, nausea, and vomiting was seen. Routine blood tests are typically not helpful in the diagnosis of PMT. Leukocytosis and mild elevation in liver function tests may be present, and metabolic acidosis in later stages is suggestive of bowel infarction.[2] In our case, leukocytosis and mild elevation in liver function tests were present. But there are more frequent complications after laparoscopic cholecystectomy with similar presentations, including bile duct injury or spillage of stones into the peritoneal cavity with subsequent abscess that have to be considered.[6]

For diagnosis of PMT, color Doppler ultrasonography is an accurate and noninvasive diagnostic method. Contrast-enhanced CT has a high sensitivity of ≤90% and can readily evaluate the extent of the disease.[20] An overview of clinical presentation, diagnostics, and therapy of PMT is given in **Table 2**.

The treatment of PMT varies from intravenous heparin anticoagulation or oral anticoagulants, selective venography with infusion of thrombolytic agents, to percutaneous or surgical thrombectomy, and, in severe cases, bowel resection. In 3 of the reported cases, intravenous heparin anticoagulation with later change to oral anticoagulants were used for treatment of PMT.[1,4,5] In 1 case, intravenous therapeutic anticoagulation and percutaneous aspiration thrombectomy was performed.[6] Our case represents the most severe case of a PMT after LCE. Venous stasis of the small bowel, the ascending colon, and transverse colon with bowel wall thickening was suggestive for impending bowel infarction. Percutaneous aspiration thrombectomy was not possible because of complete thrombosis of the

Table 2.
Clinical Presentation, Diagnostics, and Therapy of PMT

Clinical presentation	**Asymptomatic**
	Nonspecific abdominal pain
	Nausea
	Vomiting
	Diarrhea
	Anorexia
	Colicky pain
	Gastrointestinal bleeding
Diagnostics	Color Doppler ultrasonography
	CTA
	Maybe leukocytosis, elevation in liver function tests, metabolic acidosis
Therapy	Intravenous heparin anticoagulation
	Oral anticoagulants
	Selective venography with infusion of thrombolytic agents
	Percutaneous or surgical thrombectomy
	Bowel resection in case of infarction

Abbreviations: CTA, computed tomographic angiography; PMT, portomesenteric vein thrombosis.

portomesenteric system. The combination of surgical thrombectomy, selective thrombolysis, and therapeutic intravenous anticoagulation was necessary to prevent bowel ischemia and was lifesaving for our patient.

CONCLUSIONS

PMT is a rare complication after LCE. Even if the clinical presentation is nonspecific, PMT has to be kept in mind because it can be life threatening. Indication for surgical thrombectomy should be made early to prevent bowel infarction. In the absence of thrombophilic disorders or other risk factors, 6 months of anticoagulation therapy should be recommended.

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