Progressive Porto-Sinusoidal Vascular Disorder Complicated by Portal Biliopathy Requiring Liver Transplantation: A Case Report

Distúrbio Vascular Porto-Sinusoidal Complicado de Biliopatia Portal com Necessidade de Transplante Hepático: Um Relato de Caso

Elisa Pinto*[1,2], Kymentie Ferdinande*[1], Alberto Zanetto*[1,2], Umberto Cillo[1,3], Marco Senzolo[2,4]
**Equally contributed as first co-authors*

Abstract:

Porto-sinusoidal vascular disorder (PSVD) is a rare cause of non-cirrhotic portal hypertension that may be complicated by portal biliopathy (PB). We report a 16-year follow-up of a male patient who presented at age 4 with splenomegaly and extensive collateralization of the portal vein, despite patency, subsequently diagnosed with PSVD on transjugular liver biopsy. Despite multiple endoscopic treatments for variceal bleeding and transjugular intrahepatic portosystemic shunt (TIPS) placement, the patient developed progressive symptomatic PB, presenting with jaundice and abdominal pain. Imaging showed massive portal vein dilation (40 mm) and grade III biliary changes according to the Llop classification, unresponsive to percutaneous drainage and endoscopic stenting. Liver transplantation was performed, with an excellent outcome at 3-year follow-up. This case illustrates the progressive nature of PSVD complicated by portal hypertension and PB over nearly two decades, highlighting the complexity of therapeutic decision-making in these settings.

Keywords: Hepatic Veno-Occlusive Disease; Hypertension, Portal; Liver Transplantation; Portal Vein; Portasystemic Shunt, Transjugular Intrahepatic.

Resumo:

O distúrbio vascular porto-sinusoidal (DVPS) é uma causa rara de hipertensão portal não cirrótica, podendo complicar-se com biliopatia portal (BP). Apresentamos o caso de um doente com seguimento clínico por um período de 16 anos, do género masculino, que se apresentou aos 4 anos de idade com esplenomegalia e extensa colateralização da veia porta, apesar de permeável, tendo sido posteriormente diagnosticado com DVPS com base em biópsia hepática transjugular. Apesar de múltiplos tratamentos endoscópicos para hemorragia varicosa e da realização de um shunt portossistémico intra-hepático transjugular (TIPS), o doente desenvolveu biliopatia portal sintomática progressiva, manifestada por icterícia e dor abdominal. Os exames de imagem demonstraram dilatação maciça da veia porta (40 mm) e alterações biliares grau III segundo a classificação de Llop, sem resposta à drenagem percutânea ou colocação de prótese por via endoscópica. Foi submetido a transplante hepático, com evolução favorável e excelente resultado após três anos de seguimento. Este caso ilustra a natureza progressiva do DVPS complicada por hipertensão portal e biliopatia portal ao longo de quase duas décadas, salientando a complexidade da tomada de decisões terapêuticas nestes contextos clínicos.

Palavras-chave: Derivação Portossistémica Transjugular Intra-Hepática; Hepatopatia Veno-Oclusiva; Hipertensão Portal; Transplantação de Fígado; Veia Porta.

Learning points

1. In patients with PSVD and portal extensive collateralization, PB may develop insidiously, with a latency period between radiological and clinical disease.
2. TIPS effectively controls variceal bleeding in PSVD but may not prevent the progression of PB, because massive portal vein dilation and periportal collateral formation can persist despite portal decompression.
3. The Llop classification (grades I-III) offers a useful framework for staging the severity of PB and guiding therapeutic decisions, with grade III strictures carrying the highest risk of symptomatic progression.
4. Liver transplantation is curative for refractory PB and should be considered when anatomical factors preclude safe endoscopic or percutaneous management.
5. Long-term multidisciplinary follow-up is essential in PSVD to detect progression of biliopathy and to optimize the timing of definitive intervention.

[1]Department of Surgery, Oncology and Gastroenterology, University of Padova, Padova, Italy.
[2]Gastroenterology Unit, Azienda Ospedale-Università Padova, Padova, Italy.
[3]General Surgery 2-HPB Surgery and Liver Transplantation Unit, Padua University Hospital, Padova, Italy
[4]Unit of Vascular Liver Disease and Treatment of Portal Hypertension, Gastroenterology, University Hospital of Padova, Health Care Provider of the European Reference Network on Rare Liver Disorders (ERN Rare-Liver), Padova, Italy

https://doi.org/10.60591/crspmi.562

Introduction

Porto-sinusoidal vascular disorder (PSVD) is a heterogeneous group of hepatic vascular conditions characterized by portal hypertension without cirrhosis.[1,2] Importantly, the natural history of PSVD differs substantially depending on the presence or absence of portal hypertension. Patients without portal hypertension may remain stable for years, whereas those with clinically significant portal hypertension face a markedly different course, including variceal bleeding, ascites, and hepatic encephalopathy, with transplant-free survival rates of 83% and 72% at 5 and 10 years, respectively.[3] Portal vein thrombosis (PVT) is also common in this population, with a 5-year cumulative incidence of 16%.[3] Progressive collateralization of the portal venous system, whether or not associated with PVT, may lead to portal cavernoma formation and subsequent portal biliopathy (PB), a condition characterized by biliary abnormalities resulting from extrinsic compression by periportal venous collaterals and ischemic injury to the bile duct wall.[4,5] The specific prevalence of PB in patients with PSVD remains unknown. Although imaging abnormalities are present in up to 80%-100% of patients with portal cavernoma, symptomatic biliopathy requiring intervention develops in only 5%-38% of cases.[5,6] The overlap of these complications (portal hypertension and biliary-related) makes the long-term management of PSVD with portal hypertension particularly complex, requiring sequential adaptation of therapeutic strategies as the disease evolves.[5,7]

We report the long-term follow-up of a patient with PSVD who developed progressive PB over 16 years and ultimately required liver transplantation, underscoring the complexity and limitations of conventional therapies in this setting.

Case Report

A 4-year-old male was referred in 2007 for investigation of splenomegaly detected during a routine paediatric examination (Fig. 1). Abdominal ultrasound revealed extensive portal collateralization and signs of portal hypertension, including portosystemic collaterals. No formal diagnosis of portal vein thrombosis was documented. He was managed at a pediatric centre and subsequently followed by a multidisciplinary team of gastroenterologists and hepatologists. A comprehensive evaluation for conditions related to non-cirrhotic portal hypertension was conducted. This included screening for thrombophilia, multigene panel analysis, celiac

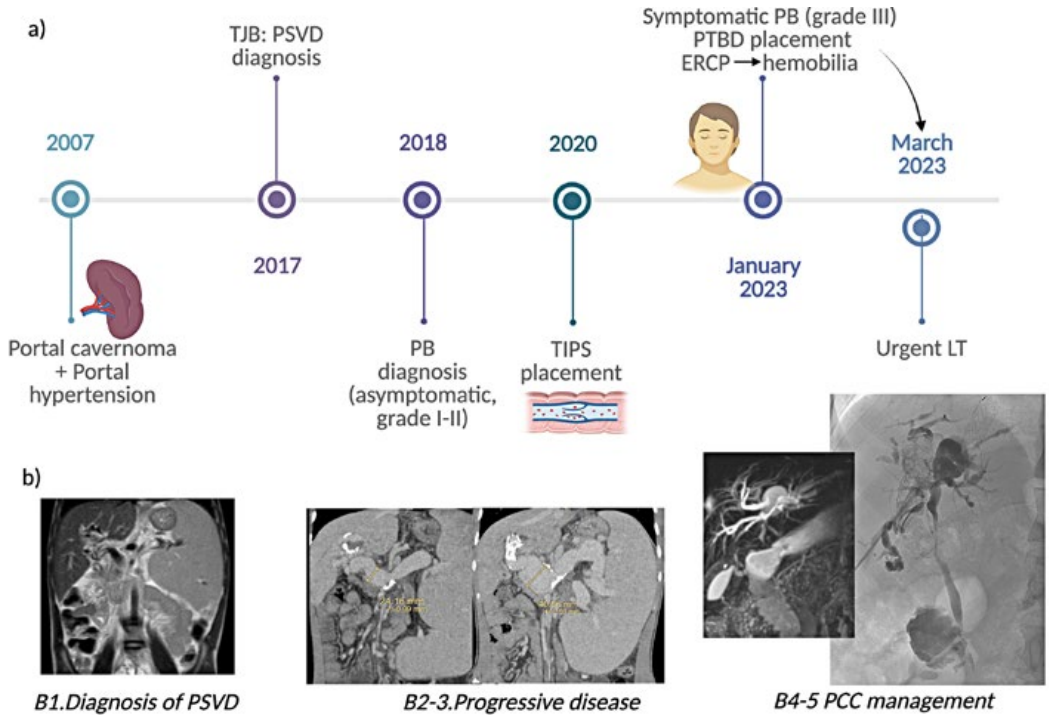

Figure 1: Clinical timeline and radiological progression of a patient with porto-sinusoidal vascular disorder (PSVD) complicated by progressive portal biliopathy (PB) over 16 years. (A) Key clinical milestones (B) Representative imaging at four timepoints demonstrating disease progression. B1: coronal MRI showing extensive portosystemic collaterals and splenomegaly. B2: axial CT showing portal vein dilatation (24 mm) with perigastric collaterals at the time of early PB detection. B3: axial CT at symptomatic PB onset showing massive portal vein dilatation (40 mm) despite functioning TIPS, with extensive paracholedochal varices. B4: MRCP showing grade III PB with diffuse intrahepatic biliary dilatation, threadlike common hepatic duct, and non-identifiable juxtapapillary common bile duct. B5: cholangiography performed during percutaneous transhepatic biliary drainage. Created in BioRender. Pinto E. (2026) https://BioRender.com/zxczmpi

PSVD, porto-sinusoidal vascular disorder; CT, computed tomography; LT, liver transplantation; MRCP, magnetic resonance cholangiopancreatography; MRI, magnetic resonance imaging; PB, portal biliopathy; PTBD, percutaneous transhepatic biliary drainage; TIPS, transjugular intrahepatic portosystemic shunt; TJB, transjugular liver biopsy; VCE, video capsule endoscopy.

disease testing, faecal calprotectin levels, and hematologic disorders such as myeloproliferative neoplasms, including *JAK2* mutation, all of which yielded negative results.

Between 2008 and 2012, the clinical course was dominated by recurrent episodes of variceal bleeding from both oesophageal and gastric varices, all successfully managed with endoscopic band ligation and sclerotherapy. Following successful endoscopic control, the patient remained clinically stable from 2012 to 2017, with no further bleeding episodes. However, given the severity and recurrence of portal hypertension-related complications in the absence of an identified underlying liver disease, a transjugular liver biopsy was performed in 2017, at age 14. Histological examination revealed obliterative portal venopathy with preserved hepatocyte architecture, minimal fibrosis, and no evidence of cirrhosis. Together with the clinical findings of portal hypertension (recurrent variceal bleeding, splenomegaly, portosystemic collaterals) and the exclusion of other causes of non-cirrhotic portal hypertension, these histological features fulfilled the diagnostic criteria for PSVD.[8]

In 2018, an abdominal ultrasound performed during routine follow-up showed new dilatation of the left intrahepatic biliary ducts not previously observed. Magnetic resonance cholangiopancreatography (MRCP) was subsequently performed to further characterize these findings and revealed the first evidence of PB: irregularities of the left hepatic ductal system, with the main left hepatic duct measuring 8 mm at its maximal calibre and the segmental branch to segment 2 dilated to 6 mm, corresponding to grade I-II changes according to the Llop classification.[9] The portal vein measured 25 mm in diameter, with extensive perigastric collateral vessels, and the spleen was markedly enlarged to 27 cm. Importantly, the patient remained clinically asymptomatic with respect to biliary symptoms, with no jaundice, abdominal pain, or episodes of cholangitis. Laboratory studies showed mildly elevated transaminases (AST 38 U/L, ALT 49 U/L), gamma-glutamyl transferase (GGT) 29 U/L, alkaline phosphatase 126 U/L, and total bilirubin 18.0 µmol/L (direct 9.4 µmol/L) (Table 1).

Shortly after transfer, he presented with two episodes of gastrointestinal bleeding. Upper gastrointestinal endoscopy was negative; however, video capsule endoscopy (VCE) revealed portal hypertensive enteropathy as the source of bleeding. Given recurrent bleeding, a transjugular intrahepatic portosystemic shunt (TIPS) was placed. A covered stent was employed and dilated to 10 mm. After TIPS, the bleeding episodes resolved completely. However, surveillance imaging over the following years demonstrated progressive portal vein dilation despite the functioning shunt, with the portal vein increasing from 25 mm (2018) to 40 mm (2023), indicating ongoing vascular remodelling unresponsive to portal decompression.

The patient remained clinically stable until January 2023, when he presented at age 20 with new-onset jaundice and right upper quadrant abdominal pain. Laboratory evaluation revealed marked cholestasis, with total bilirubin 109 µmol/L (direct 97 µmol/L) and alkaline phosphatase 223 U/L, while transaminases were only mildly elevated (AST 40 U/L, ALT 60 U/L). Notably, GGT remained low at 25 U/L (Table 1). Repeat MRCP showed dramatic progression to grade III PB: the portal vein had dilated further to 40 mm, intrahepatic biliary ducts were diffusely dilated, the common hepatic duct appeared threadlike, and the juxtapapillary common bile duct was no longer identifiable, presumably completely compressed by massive venous collaterals. The spleen measured 25 cm.

Table 1: Evolution of laboratory parameters throughout the disease course.

Parameter	2018 Asymptomatic PB (Llop grade I–II)	January 2023 Symptomatic PB (Llop grade III)	Pre-transplant (Post-PTBD)
AST (U/L)	38	40	47
ALT (U/L)	49	60	63
GGT (U/L)	29	25	24
ALP (U/L)	126	223	211
Total bilirubin (µmol/L)	18	109	83
Direct bilirubin (µmol/L)	9.4	97	36

AST, aspartate aminotransferase; ALT, alanine aminotransferase; GGT, gamma-glutamyl transferase; ALP, alkaline phosphatase; PB, portal biliopathy.

Given the severity of biliary obstruction, percutaneous transhepatic biliary drainage was placed for decompression. However, the drainage catheter malfunctioned and required replacement. Despite percutaneous drainage, the patient showed only partial biochemical improvement, with bilirubin decreasing to 83 µmol/L (direct 36 µmol/L) while cholestatic enzymes remained elevated (ALP 211 U/L) (Table 1). Endoscopic management was attempted with two sequential ERCPs, the first with plastic stent placement, the second with sphincterotomy and stent removal, but during the procedure, significant haemobilia occurred. After multidisciplinary discussion involving hepatology, interventional radiology, and transplant surgery, the consensus was that liver transplantation was the only viable option for definitive management. The patient was evaluated and listed for transplantation. Orthotopic liver transplantation was successfully performed in March 2023.

Histopathological examination of the explanted liver revealed high-grade hepatocanalicular cholestasis with ascending cholangitis, hypervascularized portal tracts, and portal vein wall sclerosis with calcification, without fibrosis or cirrhosis. A hepatic duct showed mucosal ulceration and mural inflammation, consistent with compressive and ischemic biliary injury. These findings confirmed the diagnosis of PSVD and the severity of portal biliopathy at the time of transplantation.

The postoperative course was uneventful. At 3-year follow-up in early 2026, the patient is in excellent clinical condition, with normal liver function tests and no biliary complications.

Discussion

This case provides a comprehensive example of the progressive nature of PSVD complicated by portal hypertension, from diagnosis in early childhood to liver transplantation nearly two decades later.

The natural history of PSVD with clinically significant portal hypertension has only recently been characterized in large cohorts. In the largest multicentre study to date (587 patients, median follow-up 68 months), Magaz *et al*[3] showed that despite generally preserved hepatic synthetic function, the disease follows a progressive course. Variceal bleeding was the most frequent complication, with a 5-year rebleeding rate of 18%, followed by new or worsening ascites (5-year cumulative incidence of 18%) and PVT (5-year cumulative incidence of 16%). Liver transplantation was ultimately required in 8.5% of patients, with transplant-free survival of 83% and 72% at 5 and 10 years, respectively. Our patient's course aligns with these data, with variceal bleeding and portal hypertensive enteropathy dominating the first decade, followed by progressive vascular remodelling and refractory biliopathy, a sequential accumulation of complications that extends beyond the endpoints typically reported in natural history studies.

A central finding in this case is the progressive portal vein dilation (from 25 mm to 40 mm) despite a functioning TIPS. Although TIPS effectively controlled variceal bleeding, it failed to stop vascular remodelling. Senzolo *et al*[10] demonstrated that TIPS can be successfully placed in patients with PVT and cavernomatous transformation, with portal decompression reducing the risk of rebleeding. However, the effect of TIPS on pre-existing cavernomatous changes and periportal collateral architecture has been less well studied. Our observation suggests that once cavernomatous transformation is established, architectural vascular changes may follow a self-perpetuating course, driven by both compressive (varicoid) and ischemic (fibrotic) mechanisms,[5] that is not fully reversible by portal decompression alone. This has important implications for patient monitoring, as progressive portal vein dilation despite shunting may serve as an early indicator of worsening biliary complications.

The latency between radiological and clinical PB in our patient is consistent with the prospective data reported by Llop *et al*.[9] Notably, in that cohort, biliary changes tended to stabilize early after PVT and did not progress once established. Our case challenges this observation, as biliary disease clearly progressed over a five-year interval from grade I-II to symptomatic grade III. This discrepancy may be explained by the underlying PSVD, which could create a different pathophysiological context compared to isolated PVT, with ongoing vascular remodelling and progressive portal vein dilation driving continued biliary compression. Indeed, PB itself follows a stepwise progression from preclinical to asymptomatic, symptomatic, and ultimately complicated stages.[11] This progression mirrors the sequence of complications observed in our patient, which began with variceal bleeding, followed by portal hypertensive enteropathy, asymptomatic biliary changes, and finally refractory cholangiopathy requiring transplantation.

The management of this patient illustrates both the value and the limitations of the stepwise therapeutic approach advocated by current consensus. The 2014 consensus[11] and a recent systematic review[5] recommend conservative management with ursodeoxycholic acid for asymptomatic PB, endoscopic therapy for symptomatic disease, and portal decompression when anatomically feasible. In our patient, endoscopic therapy controlled variceal bleeding for over a decade, and TIPS provided effective hemostasis. However, when progressive biliary obstruction developed in the context of massive portal vein dilation and extensive paracholedochal varices, endoscopic and percutaneous biliary stenting failed to relieve biliary obstruction.

Liver transplantation is required in a minority of PSVD patients, and when performed, outcomes are acceptable. In a multicentre study of 79 transplanted patients, post-transplant survival was 82% and 69% at 1 and 5 years, with refractory ascites, encephalopathy, and hepatopulmonary syndrome as the main indications.[12] Although rarely necessary for PB, liver transplantation remains the only option when alternative approaches are unfeasible.[13,14] The excellent 3-year post-transplant outcome in our patient confirms that transplantation offers a possible treatment even in these extreme settings. Notably, histopathological examination of the explanted liver provided further confirmation of the PSVD diagnosis. Portal venous wall sclerosis with calcification represents a macroscopic correlate of phlebosclerosis, recognized as one of the histological hallmarks of PSVD. Similarly, the hypervascularized portal tracts are consistent with the aberrant vascular architecture described in this condition. Although the explant pathology was dominated by the consequences of biliary obstruction (cholestasis, cholangitis), the absence of cirrhosis despite decades of portal hypertension is itself a defining feature of PSVD and further corroborates the diagnosis.

While this cannot be determined from a single case, the trajectory observed here suggests that the combination of progressive portal vein dilation and worsening biliary grade on surveillance imaging may identify patients at risk of reaching a point where conventional therapies are no longer feasible. Prospective studies are needed to define predictive factors for this severe trajectory within the PSVD population. ■

Contributorship Statement

EP, KF – Writing of manuscript

AZ, UC – Writing and revision of manuscript, senior supervisor of manuscript

MS – Writing and revision of manuscript, treating physician, senior supervisor of manuscript

All authors approved the final version to be published.

Declaração de Contribuição

EP, KF – Redação do manuscrito
AZ, UC – Redação e revisão do manuscrito, supervisores séniores do manuscrito
MS – Redação e revisão do manuscrito, médico assistente, supervisor sénior do manuscrito
Todos os autores aprovaram a versão final a ser publicada.

Ethical Disclosures

Conflicts of Interest: The authors have no conflicts of interest to declare.
Financing Support: This work has not received any contribution, grant or scholarship.
Confidentiality of Data: The authors declare that they have followed the protocols of their work center on the publication of patient data.
Patient Consent: Consent for publication was obtained.
Provenance and Peer Review: Not commissioned; externally peer-reviewed

Responsabilidades Éticas

Conflitos de Interesse: Os autores declaram a inexistência de conflitos de interesse na realização do presente trabalho.
Fontes de Financiamento: Não existiram fontes externas de financiamento para a realização deste artigo.
Confidencialidade dos Dados: Os autores declaram ter seguido os protocolos da sua instituição acerca da publicação dos dados de doentes.
Consentimento: Consentimento do doente para publicação obtido.
Proveniência e Revisão por Pares: Não comissionado; revisão externa por pares.

Corresponding Author / Autor Correspondente

Marco Senzolo - marcosenzolo@hotmail.com
Unit of Vascular Liver Diseases and Treatment of Portal Hypertension, Gastroenterology, Department of Surgery, Oncology and Gastroenterology,
Via Giustiniani 2, 35128 Padua, Italy.

Received / Recebido: 10/02/2026
Accepted / Aceite: 09/03/2026
Published online / Publicado online: 15/04/2026
Published / Publicado: 15/04/2026

REFERENCES

1. Venkatesan P. WHO world malaria report 2024. Lancet Microbe. De Gottardi A, Rautou PE, Schouten J, Rubbia-Brandt L, Leebeek F, Trebicka J, et al. Porto-sinusoidal vascular disease: proposal and description of a novel entity. Lancet Gastroenterol Hepatol. 2019;4:399-411. doi: 10.1016/S2468-1253(19)30047-0.
2. Guido M, Sarcognato S, Sonzogni A, Lucà MG, Senzolo M, Fagiuoli S, et al. Obliterative portal venopathy without portal hypertension: an underestimated condition. Liver Int. 2016;36:454-60. doi: 10.1111/liv.12936.
3. Magaz M, Giudicelli-Lett H, Abraldes JG, Nicoara-Farcau O, Turon F, Rajoriya N, et al. Porto-sinusoidal vascular liver disorder with portal hypertension: Natural history and long-term outcome. J Hepatol. 2025;82:72-83. doi: 10.1016/j.jhep.2024.07.035.
4. Khuroo MS, Rather AA, Khuroo NS, Khuroo MS. Portal biliopathy. World J Gastroenterol. 2016;22:7973-82. doi: 10.3748/wjg.v22.i35.7973.
5. Pinto E, Elkrief L, Hernández-Gea V, Busatto A, Ferdinande K, Zanetto A, et al. Portal cavernoma cholangiopathy: A systematic review of current understanding, clinical significance, and management. Hepatol Commun. 2025;9:e0833. doi: 10.1097/HC9.0000000000000833.
6. Condat B, Vilgrain V, Asselah T, O'Toole D, Rufat P, Zappa M, et al. Portal cavernoma-associated cholangiopathy: a clinical and MR cholangiography coupled with MR portography imaging study. Hepatology. 2003;37:1302-8. doi: 10.1053/jhep.2003.50232.
7. Franceschet I, Zanetto A, Ferrarese A, Burra P, Senzolo M. Therapeutic approaches for portal biliopathy: A systematic review. World J Gastroenterol. 2016;22:9909-20. doi: 10.3748/wjg.v22.i45.9909.
8. De Gottardi A, Sempoux C, Berzigotti A. Porto-sinusoidal vascular disorder. J Hepatol. 2022;77:1124-35. doi: 10.1016/j.jhep.2022.05.033.
9. Llop E, de Juan C, Seijo S, García-Criado A, Abraldes JG, Bosch J, et al. Portal cholangiopathy: radiological classification and natural history. Gut. 2011;60:853-60. doi: 10.1136/gut.2010.230201.
10. Senzolo M, Tibbals J, Cholongitas E, Triantos CK, Burroughs AK, Patch D. Transjugular intrahepatic portosystemic shunt for portal vein thrombosis with and without cavernous transformation. Aliment Pharmacol Ther. 2006;23:767-75. doi: 10.1111/j.1365-2036.2006.02820.x.
11. Dhiman RK, Saraswat VA, Valla DC, Chawla Y, Behera A, Varma V, et al. Portal cavernoma cholangiopathy: consensus statement of a working party of the Indian national association for study of the liver. J Clin Exp Hepatol. 2014;4:S2-S14. doi: 10.1016/j.jceh.2014.02.003.
12. Magaz M, Giudicelli-Lett H, Nicoara-Farcau O, Rajoriya N, Goel A, Raymenants K, et al. Liver Transplantation for Porto-sinusoidal Vascular Liver Disorder: Long-term Outcome. Transplantation. 2023;107:1330-40. doi: 10.1097/TP.0000000000004444.
13. Vibert E, Azoulay D, Aloia T, Pascal G, Veilhan LA, Adam R, et al. Therapeutic strategies in symptomatic portal biliopathy. Ann Surg. 2007;246:97-104. doi: 10.1097/SLA.0b013e318070cada.
14. Agarwal AK, Sharma D, Singh S, Agarwal S, Girish SP. Portal biliopathy: a study of 39 surgically treated patients. HPB. 2011;13:33-9. doi: 10.1111/j.1477-2574.2010.00232.x.