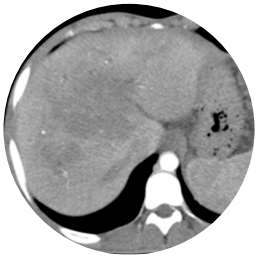

# Hepatic sinusoidal obstructive syndrome due to the consumption of alkyl nitrites. A case report

## Síndrome obstructivo sinusoidal hepático secundario al consumo de nitritos de alquilo. Presentación de caso

Julia Andrea Rodríguez[1]
Diana Marcela Romero[1]
Liliana Arias[2]

DOI: https://doi.org/10.53903/01212095.174

Key words (MeSH)
Hypertension, portal
Hepatic veno-occlusive disease
Magnetic resonance imaging

Palabras clave (DeCS)
Hipertensión portal
Enfermedad venooclusiva hepática
Imagen por resonancia magnética

## Summary

The sinusoidal obstructive syndrome is a cause of post-sinusoidal hepatic portal hypertension. Caused by hepatotoxic agents that damage the endothelium of the central venule, which results in obstruction of the blood flow and congestion, leading to post-sinusoidal portal hypertension. This pathology is very rare, and its main etiology is hematopoietic cell transplantation, although other etiologies have been described such as the use of hepatotoxic agents that include chemotherapy, radiotherapy, and intake of alkaloids. The clinical presentation of these patients does not vary significantly with respect to the other causes of portal hypertension, and therefore diagnostic images play a key role in the initial approach of these patients. We present the case of a 16 year old patient with a history of consumption of psychoactive substances, who showed portal hypertension due to the consumption of alkyl nitrites.

## Resumen

El síndrome obstructivo sinusoidal es una causa de hipertensión portal hepática postsinusoidal. Se produce como consecuencia de agentes hepatotóxicos que lesionan el endotelio de la vénula central, lo que lleva a un bloqueo del flujo sanguíneo y congestión que generan hipertensión portal postsinusoidal. Esta patología es muy rara y su principal causa es el trasplante de células hematopoyéticas, aunque también se han descrito otras causas como el uso de agentes hepatotóxicos que incluyen quimioterapia, radioterapia e ingesta de alcaloides. La clínica de estos pacientes no varía significativamente con respecto a la clínica de los pacientes con otras causas de hipertensión portal por lo que las imágenes diagnósticas juegan un papel clave en el enfoque de estos pacientes. Se describe el caso de un paciente de 16 años de edad con antecedente de consumo de sustancias psicoactivas, quien se presenta con hipertensión portal hepática postsinusoidal por consumo de nitritos de alquilo.

## Introduction

Portal hypertension is defined as an increase in portal venous pressure of 5 mmHg above the pressure of the inferior vena cava or a pressure of 15 mmHg in the splenic vein or greater than 30 cm H2O in the portal vein (1). Pathophysiologically, portal hypertension is divided into pre-hepatic, hepatic and post-hepatic (2). Prehepatic portal hypertension is caused by obstruction of the portal venous system before it enters the liver, usually by thrombosis (2). Post-hepatic portal hypertension occurs due to increased pressure in the suprahepatic veins or in cardiac cavities, secondary to pathologies such as Budd-Chiari syndrome or congestive heart failure (2). Hepatic portal hypertension is subdivided into presinusoidal, sinusoidal and postsinusoidal (2). Presinusoidal hypertension is secondary to involvement of the intrahepatic portal branches due to etiologies such as schistosomiasis or primary biliary cirrhosis. Sinusoidal hypertension is the most common and its main etiology is cirrhosis due to distortion of the vascular channels or sinusoids (2). Post-sinusoidal syndrome, also known as sinusoidal obstructive syndrome or veno-occlusive syndrome, is produced as a consequence of hepatotoxic agents that injure the endothelium of the central venule, leading to its detachment towards the centrilobulillar area of the hepatic acinus, which generates blockage of blood flow and congestion causing post-sinusoidal portal hypertension (1, 2).

Post-sinusoidal portal hypertension is a very rare disease, with an incidence between 9.6% and 17.3% (1). The most frequent cause is hematopoietic stem cell transplantation (HSCT) and affects 14% of patients who undergo this treatment. Other causes are hepatotoxic agents such as chemotherapy, radiotherapy and ingestion

[1]Residente de Radiología del Hospital San Ignacio. Bogotá, Colombia.

[2]Radióloga, docente del Hospital San Ignacio. Bogotá, Colombia.

Departamento de Imágenes Diagnósticas del Hospital Universitario San Ignacio.

of toxins such as alkaloids (1, 2). The usual clinical presentation is hepatomegaly, right upper quadrant pain, jaundice and ascites (1). Sinusoidal obstructive syndrome has a mortality rate of up to 80%. Imaging is key to a diagnostic approach. Initially, ultrasound is useful in the evaluation of differential diagnoses in patients with jaundice and abdominal pain. Findings of sinusoidal obstruction syndrome include hepatomegaly, splenomegaly, ascites, thickening of the gallbladder wall, portal vein dilatation (diameter more than 12 mm), enlarged suprahepatic veins, recanalization of the paraumbilical vein, and the liver parenchyma may be heterogeneous (1, 3). In portal Doppler, the following are identified: portal peak velocity less than 10 cm/s with reverse flow, loss of phasicity of the suprahepatic veins, congestion index less than 0.1 and hepatic artery resistance index greater than 0.75 (1). In computed axial tomography (CAT) the findings are similar to those of ultrasound, and include heterogeneous enhancement of the hepatic parenchyma and the identification of multiple venous collaterals (4). Magnetic resonance imaging (MRI) is useful after portal Doppler because it helps to differentiate slow portal venous flow from thrombosis, allows better evaluation of the parenchymal enhancement pattern to rule out thrombosis of the suprahepatic veins, and facilitates better visualization of venous collaterals and mesenteric edema from venous congestion; it is the study of choice to characterize the hepatic parenchyma to rule out other causes of portal hypertension (3-5).

## Presentation of the case

A 16-year-old male patient with a history of anxiety disorder and psychoactive substance use -tetrahydrocannabinol and alkyl nitrites ("Popper") - consults for abdominal pain, jaundice and hematemesis. The clinical history on admission mentions an unclear history of portal hypertension of unknown etiology. Physical examination revealed jaundice, pain on palpation of the right upper quadrant of the abdomen and positive ascitic wave. Paraclinical tests demonstrate bilirubin of more than 2 mg/dL. He initially underwent an ultrasound of the abdomen with findings of hepatomegaly, heterogeneous hepatic echogenicity and splenomegaly. Subsequently, a computed axial tomography (CT) scan of the abdomen with intravenous contrast medium identified the same findings described in the ultrasound and also showed multiple venous collaterals in the hepatic hilum, perigastric and splenic hilum (Figure 1). An MRI of the abdomen with intravenous contrast medium was performed to evaluate different causes of portal hypertension, in which permeability of the portal system with multiple venous collaterals, edema of the mesenteric fat, heterogeneity of the hepatic parenchyma without defining focal lesions and hepatosplenomegaly were documented (figure 2). Finally, liver biopsy resulted in veno-occlusive liver disease.

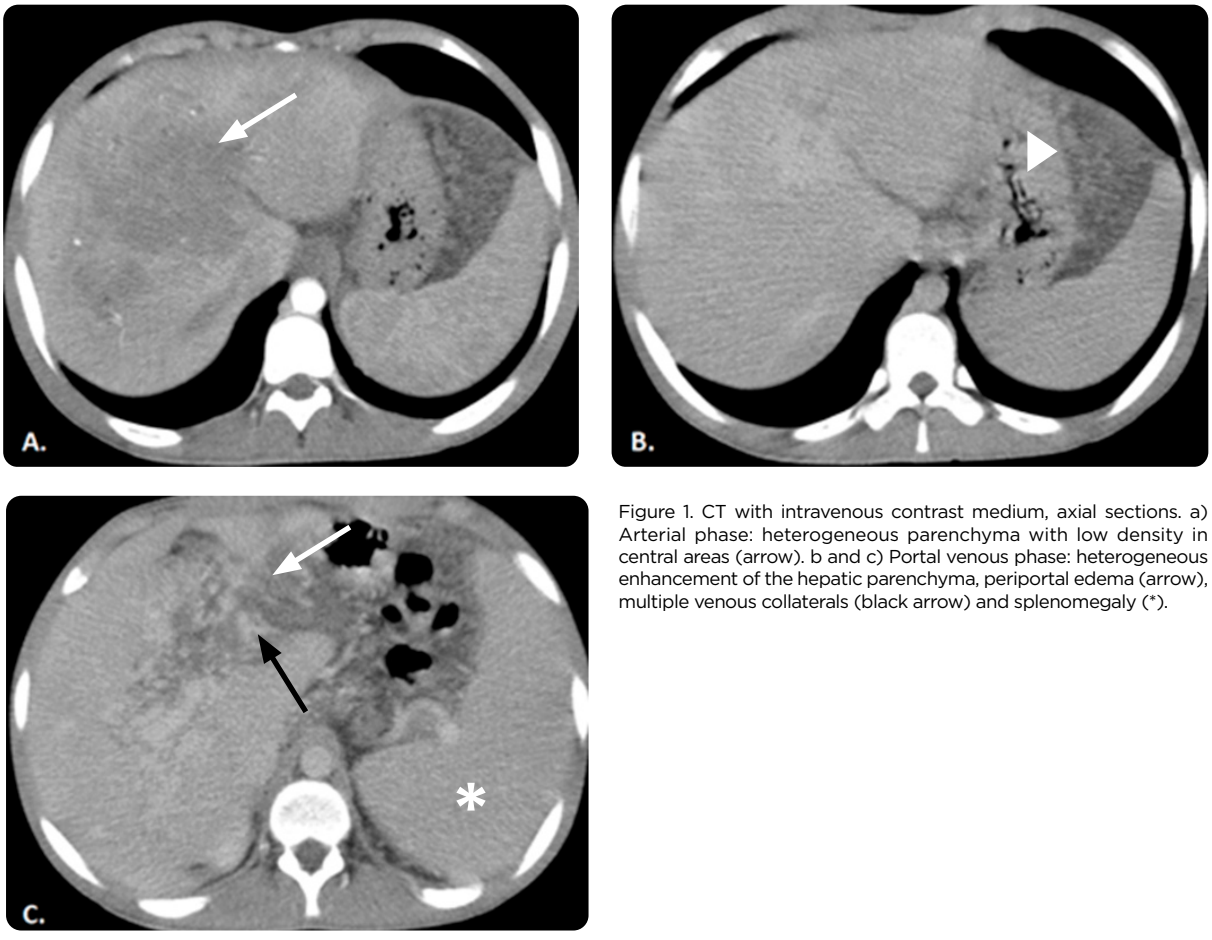


Figure 1. CT with intravenous contrast medium, axial sections. a) Arterial phase: heterogeneous parenchyma with low density in central areas (arrow). b and c) Portal venous phase: heterogeneous enhancement of the hepatic parenchyma, periportal edema (arrow), multiple venous collaterals (black arrow) and splenomegaly (*).

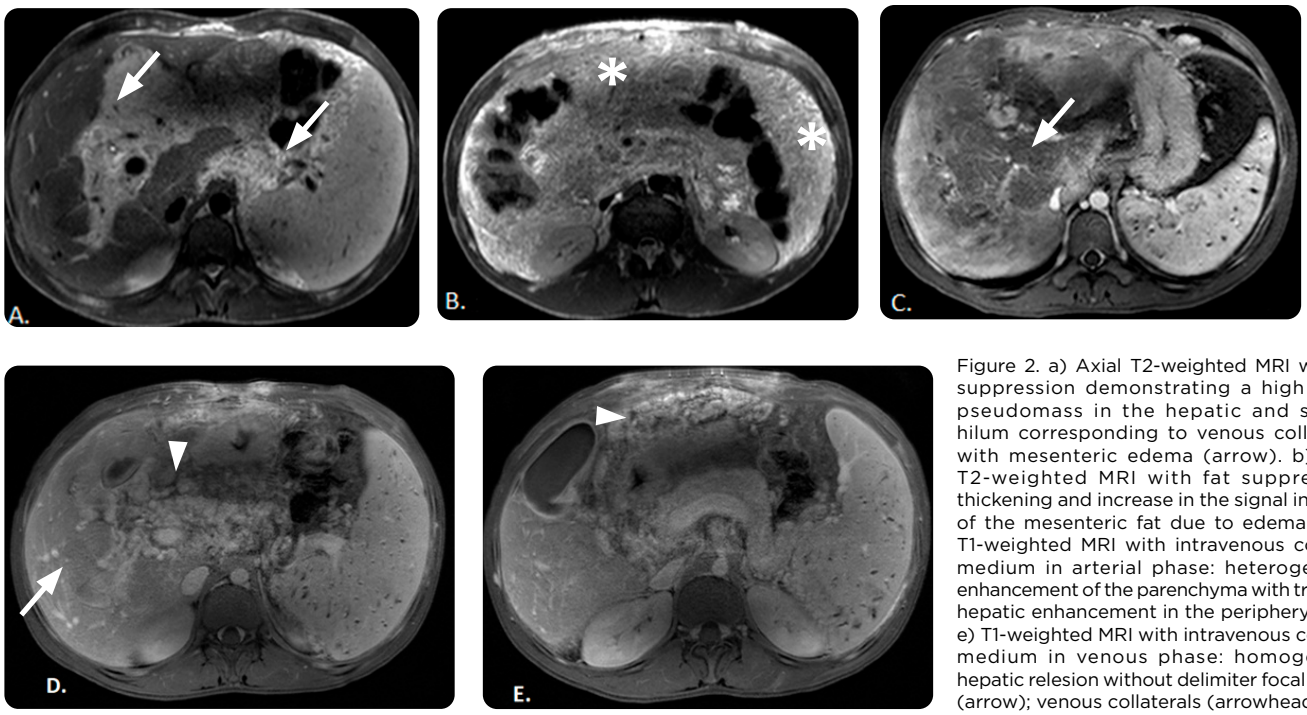


Figure 2. a) Axial T2-weighted MRI with fat suppression demonstrating a high signal pseudomass in the hepatic and splenic hilum corresponding to venous collaterals with mesenteric edema (arrow). b) Axial T2-weighted MRI with fat suppression: thickening and increase in the signal intensity of the mesenteric fat due to edema (*). c) T1-weighted MRI with intravenous contrast medium in arterial phase: heterogeneous enhancement of the parenchyma with transient hepatic enhancement in the periphery. d and e) T1-weighted MRI with intravenous contrast medium in venous phase: homogenized hepatic relesion without delimiter focal lesions (arrow); venous collaterals (arrowhead).

## Discussion

Sinusoidal obstruction syndrome (also called veno-occlusive disease) is a rare cause of post-sinusoidal hepatic portal hypertension secondary to a toxic lesion of the endothelium of the central venule, which leads to its detachment and embolization towards the central zone of the acinus generating fibrosis and necrosis in this zone and, finally, producing an obstruction to blood flow and portal hypertension (1, 2). Its main etiology is hematopoietic cell transplantation; however, hepatotoxic substances such as alkyl nitrites (used as psychoactive substances for recreational use) must be considered, mainly in patients without other antecedents (3). In the case described here, the patient is a young man with a history of anxiety and substance use who was documented to have portal hypertension of unknown origin. Diagnostic imaging is useful in the evaluation of these patients: first, to rule out other causes of abdominal pain and jaundice; second, to identify signs of portal hypertension; and third, to evaluate the different causes of portal hypertension (1, 4). portal hypertension (1, 4, 5). In case signs of portal hypertension are identified, it is advisable to evaluate the image taking into account a checklist in which the patency of the portal system is initially evaluated to rule out pre-hepatic causes, subsequently evaluate patency and size of the suprahepatic veins to rule out Budd-Chiari syndrome as well as congestive heart failure as causes of post-hepatic portal hypertension and, finally, evaluate the hepatic parenchyma in search of signs of cirrhosis or lesions that may suggest a sinusoidal or presinusoidal etiology (1, 3, 4).

## Conclusion

Veno-occlusive liver disease is a very rare pathology with high mortality, so it is important to know that alkyl nitrite consumption can cause it. Additionally, an adequate imaging approach to the findings of portal hypertension will be key to raise possible etiologies and help in the diagnostic approach of these patients.

## References

1. Ravaioli F, Colecchia A, Alemanni LV. Role of imaging techniques in liver veno-occlusive disease diagnosis: recent advances and literature review. Expert Rev Gastroenterol Hepatol. 2019;13(5):463-84. DOI:10.1080/17474124.2019.1588111
2. Roskams T, Baptista A, Bianchi L. Histopathology of portal hypertension: a practical guideline. Histopathology. 2003;42:2-13.
3. Mortelé KJ, Vlierberghe HV, Wiesner W. Hepatic veno occlusive disease: MRI findings. Abdom Imaging. 2002;27:523-6. DOI: 10.1007/s00261-001-0097-5
4. Van den Bosch MA, Van Hoe L. MR imaging findings in two patients with hepatic veno-occlusive disease following bone marrow transplantation. Eur Radiol. 2000;10:1290-3.
5. Mehmet S, Mortelé K, Binkert C, et al. CT features of hepatic venooclusive disease and Hepatic Graft-versus-host disease in patients after hematopoietic stem cell transplantation. AJR. 2006;186(6):1497-501. doi: 10.2214/AJR.05.0539.

## Correspondence

Julia Andrea Rodríguez
Hospital Universitario San Ignacio
Carrera 7 # 40-62
julia.rodriguez@javeriana.edu.co

Received for evaluation: February 17, 2022
Accepted for publication: April 26, 2022