CLINICAL STUDY

Segmental Liver Ischemia/Infarction after Elective Transjugular Intrahepatic Portosystemic Shunt Creation: Clinical Outcomes in 10 Patients

Jorge E. Lopera, MD, Venkata Katabathina, MD, Brian Bosworth, MD, Deepak Garg, MD, Ghazwan Kroma, MD, Andres Garza-Berlanga, MD, Rajeev Suri, MD, and Michael Wholey, MD

ABSTRACT

Purpose: To determine the clinical significance and potential mechanisms of segmental liver ischemia and infarction following elective creation of a transjugular intrahepatic portosystemic shunt (TIPS).

Materials and Methods: A retrospective review of 374 elective TIPS creations between March 2006 and September 2014 was performed, yielding 77 contrast-enhanced scans for review. Patients with imaging evidence of segmental perfusion defects were identified. Model for End-stage Liver Disease scores, liver volume, and percentage of liver ischemia/infarct were calculated. Clinical outcomes after TIPS creation were reviewed.

Results: Ten patients showed segmental liver ischemia/infarction on contrast-enhanced imaging after elective TIPS creation. Associated imaging findings included thrombosis of the posterior division (n = 7) and anterior division (n = 3) of the right portal vein (PV). The right hepatic vein was thrombosed in five patients, as was the middle hepatic vein in three and the left hepatic vein in one. One patient had acute thrombosis of the shunt and main PV. Three patients developed acute liver failure: two died within 30 days and one required emergent liver transplantation. One patient died of acute renal failure 20 days after TIPS creation. A large infarct in a transplant recipient resulted in biloma formation. Five patients survived without additional interventions with follow-up times ranging from 3 months to 5 years.

Conclusions: Segmental perfusion defects are not an uncommon imaging finding after elective TIPS creation. Segmental ischemia was associated with thrombosis of major branches of the PVs and often of the hepatic veins. Clinical outcomes varied significantly, from transient problems to acute liver failure with high mortality rates.

ABBREVIATIONS

PV = portal vein, TIPS = transjugular intrahepatic portosystemic shunt

Liver ischemia is a rarely reported complication of transjugular intrahepatic portosystemic shunt (TIPS) creation. The ischemia is usually diagnosed as a triangular perfusion defect on contrast-enhanced images. This complication has been described in several isolated case reports, discovered as an incidental imaging finding in asymptomatic patients (1,2), or had led to liver infarction. Liver infarction after TIPS creation can present with right upper quadrant pain and marked transient increases in liver enzyme levels (3–5); in rare cases, it precipitates acute liver failure with high mortality rates (6,7). Potential mechanisms postulated for liver ischemia after TIPS creation include hepatic arterial problems such as thrombosis, pseudoaneurysms, or arteriovenous fistulas, usually related to the needle punctures during the procedure or, rarely, to extrinsic compression of the hepatic artery by the stent (8–11). Hepatic vein thrombosis has also been implicated in some case reports (2,4,5). The exact etiology of segmental liver ischemia/infarcts is still unknown. The clinical evolution may depend on the preexisting liver reserve and the size of ischemia/infarct, among other factors.

The purpose of the present study is to report the imaging findings, potential mechanisms, and clinical out-

From the Department of Radiology, University of Texas Health Science Center at San Antonio, 7703 Floyd Curl Dr., San Antonio, TX 78229. Received August 7, 2014; final revision received November 29, 2014; accepted November 30, 2014. **Address correspondence to** J.E.L.; E-mail: lopera@uthscsa.edu

None of the authors have identified a conflict of interest.

J Vasc Interv Radiol 2015; XX:▮▮▮–▮▮▮

http://dx.doi.org/10.1016/j.jvir.2014.11.041

comes in 10 patients at a single academic institution in whom segmental liver ischemia/infarction developed after elective TIPS creation.

MATERIALS AND METHODS

With institutional review board approval, a retrospective review of electronic medical records of 374 patients who underwent elective TIPS creation at one of two tertiary-care medical centers between March 2006 and September 2014 was performed. Seventy-seven contrast-enhanced computed tomography (CT) or magnetic resonance (MR) imaging scans obtained after the TIPS procedures were reviewed and compared with scans obtained before the procedure to assess imaging findings indicative of liver ischemia after the procedure. Patients with imaging evidence of segmental hepatic perfusion defects were included in the study. Perfusion defects were defined as wedge-shaped areas of hypodensity on CT scans, or hypointensity on MR images, with lack of arterial and venous enhancement. Associated findings such as arterial or venous thrombosis and other potential complications were determined. Total liver volume and percentage of liver infarct were calculated on a dedicated workstation (IntelliSpace; Philips, Best, The Netherlands). Medical records were retrospectively reviewed for clinical outcomes and long-term follow-up. Model for End-stage Liver Disease scores and liver function test results before and after the procedures were analyzed.

Ten patients (six female and four male; age range, 44–75 y; mean age, 56 y) showed wedge-shaped perfusion defects on follow-up imaging after elective TIPS creation. Indications for the procedure included refractory ascites in seven patients, recurrent variceal bleeding in two, and hepatic hydrothorax in one. Two patients had received liver transplants previously. Causes of cirrhosis included cryptogenic causes in four, hepatitis C virus in three, alcohol in two, and primary sclerosing cholangitis in one (Table). Imaging obtained after the procedure included contrast-enhanced CT scans in nine patients and MR imaging in one. Scans were obtained 1–61 days (mean, 14 d) after the procedure. Clinical indications for the scans were abdominal pain and/or abnormal liver function test results in eight patients and suspected intraperitoneal bleeding in one patient. The perfusion defect was incidentally diagnosed in one patient whose scan was obtained for transplant evaluation 61 days after the procedure. In all 10 patients, axial images before TIPS creation and portograms obtained during TIPS creation confirmed patency of the main and major branches of the portal vein (PV). TIPS procedures were performed in a standard fashion with the use of VIATORR stent-grafts (W.L. Gore and Associates, Flagstaff, Arizona) in nine patients (Fig 1) and a Wallstent (Boston Scientific, Natick, Massachusetts) in one patient. Portosystemic gradients showed a significant reduction from a mean of 19 mm Hg (range, 27–11 mm Hg) before the procedure to a mean of 6.8 mm Hg (range, 13–0 mm Hg) afterward.

RESULTS

Imaging Findings

The percentages of liver infarction were 11%–40% (mean, 21%) of the total liver volume. Associated imaging findings included thrombosis of the posterior division of the right PV in seven patients and of the anterior division of the right PV in three (Fig 1). The right hepatic vein was thrombosed in five patients, the middle hepatic vein in three, and the left hepatic vein in one. In one patient, all three hepatic veins were patent. In another, the veins were not clearly seen (Table). In one patient, there was acute thrombosis of the shunt extending into the main PV diagnosed 15 days after the procedure. Follow-up imaging was available in five patients and showed atrophy of the affected segments in three and no significant volume loss in two.

Laboratory Data

Liver function tests showed marked (ie, five times normal values) transient increase in aminotransferase levels with minimal increase in bilirubin levels in two patients, progressive marked increase in total bilirubin levels with minimal increase in aminotransferase levels in two, marked increase of aminotransferase and bilirubin levels in two, and minimal to no increase in liver enzyme and bilirubin levels in four. Mean Model for End-stage Liver Disease scores were 13 before TIPS creation (range, 7–18), and 19 afterward (range, 7–28) (Table).

CLINICAL EVOLUTION

Acute liver failure developed in three patients: two died within 30 days and one required emergent liver transplantation 1 month after the procedure. One patient presented with acute TIPS thrombosis 15 days after the procedure, and a CT scan showed a 33% perfusion defect in the right lobe with associated shunt and main PV thrombosis. TIPS revision with thrombectomy was performed, but acute renal failure developed and the patient died 25 days after the procedure. A patient who had received a liver transplant and had a large 40% liver infarct with associated thrombosis of the anterior branch of the right PV and middle and left hepatic veins developed a large area of necrosis, with subsequent biloma formation that required complex drainage interventions (Fig 2). This patient presented with fever and abdominal pain 10 days after the TIPS procedure. After percutaneous drainage of the collection, a large fistula with communication with the right biliary system was noted. The biliary fistula was finally controlled after embolization with coils and placement of a plastic biliary