

# Emergent Salvage Direct Intrahepatic Portocaval Shunt Procedure for Acute Variceal Hemorrhage

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## ABSTRACT

**Purpose:** To review the safety and effectiveness of direct intrahepatic portocaval shunt (DIPS) creation with variceal embolization for acute variceal hemorrhage after a failed transjugular intrahepatic portosystemic shunt (TIPS) creation attempt or in patients with prohibitive anatomy.

**Materials and Methods:** Transjugular intrahepatic portosystemic shunt and DIPS procedures performed for variceal hemorrhage between January 2008 and July 2014 were reviewed. The default procedure was TIPS creation, with DIPS creation reserved for patients with unfavorable anatomy or who had technically unsuccessful TIPS creation. Thirteen patients underwent DIPS creation (mean age, 60 y  $\pm$  12; Child–Pugh class A/B/C, 8%/62%/30%; Model for End-stage Liver Disease score, 15  $\pm$  5; range, 8–26) and 117 underwent TIPS creation. Four patients underwent a TIPS attempt and were converted to DIPS creation upon technical failure; 9 were treated primarily with DIPS creation because of preprocedural imaging revealing unfavorable anatomy (intrahepatic portal thrombosis, n = 2; venous distortion from prior hepatic resections, n = 2; severely angulated hepatic veins, n = 5).

**Results:** Direct intrahepatic portocaval shunt creation with variceal embolization (six gastric or esophageal; seven stomal, duodenal, or rectal) was successful in all patients; 11 also had concomitant variceal sclerotherapy. Mean DIPS procedure time was less than 2 hours. There was 1 major procedural complication. During a mean follow-up of 13.0 months  $\pm$  15.5, 1 patient developed DIPS thrombosis and recurrent hemorrhage; 1 patient underwent successful transplantation. Two deaths were observed within 30 days, neither associated with recurrent hemorrhage.

**Conclusions:** Direct intrahepatic portocaval shunt creation appears to be a safe, expedient, and effective treatment for patients with acute variceal hemorrhage who are poor anatomic candidates for TIPS creation or who have undergone unsuccessful TIPS creation attempts.

## ABBREVIATIONS

DIPS = direct intrahepatic portocaval shunt, MELD = Model for End-stage Liver Disease, TIPS = transjugular intrahepatic portosystemic shunt

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From the SIR 2015 Annual Meeting.

D.Y.S. is a paid consultant for Amgen (Thousand Oaks, California), BTG (West Conshohocken, Pennsylvania), Sirtex Medical (North Sydney, Australia), W.L. Gore & Associates (Flagstaff, Arizona), Covidien (Mansfield, Massachusetts), Guerbet (Villepinte, France), Cook (Bloomington, Indiana), Boston Scientific, Inc. (Marlboro, Massachusetts), and Codman (Raynham, Massachusetts), and serves on the advisory boards of SureFire Medical (Westminster, Colorado), Koli Medical (Fremont, California), Northwind Medical (San Jose, California), Treus Medical (Redwood City, California), RadiAction Medical (Tel Aviv, Israel), EmbolX (Los Altos, California), and Lunar Design (Palo Alto, California). None of the other authors have identified a conflict of interest.

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*J Vasc Interv Radiol* 2015; 26:829–834

<http://dx.doi.org/10.1016/j.jvir.2015.03.004>

Variceal hemorrhage represents a major cause of morbidity and mortality in patients with portal hypertension and cirrhosis (1–4). The creation of a transjugular intrahepatic portosystemic shunt (TIPS) has been shown to decrease recurrent hemorrhage and mortality compared with endoscopic band ligation and vasoactive drugs (5). Creation of a TIPS, however, may be technically difficult or impossible in patients with hepatic venous anomalies, intra- or extrahepatic portal venous obstruction, or distorted postsurgical anatomy.

The creation of an intravascular ultrasound (US)–guided direct intrahepatic portocaval shunt (DIPS) is an alternative to TIPS creation (6,7) with high rates of technical and clinical success. DIPS creation has been primarily reported in the elective setting for portal hypertension complicated by ascites. There is less

experience with the emergent creation of DIPSs for acute variceal hemorrhage, with DIPSs likely associated with additional setup time at less experienced centers. In the largest series of 40 patients treated with the DIPS procedure for the sequela of portal hypertension (8), only five patients were treated for bleeding. In these patients, there was one episode of recurrent bleeding at 1 year. The technical success rate for the entire cohort was 100%, with the clinical success rate being 74% for patients treated for ascites.

The purpose of the present study was to investigate the application of the DIPS procedure for acute variceal hemorrhage, reserved for use after a failed TIPS attempt or in patients with prohibitive anatomy for TIPS.

## MATERIALS AND METHODS

This study was an institutional review board–approved, single-center, retrospective review of all portosystemic shunt procedures performed between January 2008 and July 2014. Data were handled in accordance with the Health Insurance Portability and Accountability Act.

At the performing institution, TIPS creation is the default emergent procedure performed for acute variceal hemorrhage. DIPS creation is reserved for use after a failed TIPS attempt or in patients with prohibitive anatomy, eg, severe cranial angulation and other hepatic venous anomalies, intra- or extrahepatic portal venous thrombosis or obstruction, or distorted postsurgical vascular anatomy such as cranial displacement of intrahepatic portal veins.

During the study period, 130 shunt procedures were performed for variceal hemorrhage. Of these, 13 were DIPSs and 117 were conventional TIPSs. All patients first underwent diagnostic endoscopy with attempted band ligation and/or sclerotherapy and were referred for chronic or acute refractory hemorrhage. No patients refused TIPS or DIPS creation, and no surgical shunts were performed for variceal hemorrhage during the study period.

Of the patients who received a DIPS, the mean age was 60 years  $\pm$  12, 46% were male, Child–Pugh–Turcotte class A, B, and C disease was seen in 8%, 62%, and 30%, respectively, and mean Model for End-stage Liver Disease (MELD) score was 15  $\pm$  5 (standard deviation; range, 8–26; **Table 1**). Four patients underwent a TIPS attempt and were converted to DIPS upon technical failure. Nine were treated primarily with DIPS creation because of cross-sectional imaging revealing unfavorable anatomy: two with intrahepatic portal vein thrombosis, two with distortion of venous anatomy from earlier hepatic resections, and five with severely cranially angulated hepatic veins (**Fig 1**). In patients with intrahepatic portal vein occlusion, any patency, even partial, of the main portal vein allowed US-guided puncture from the inferior vena cava and creation of a

**Table 1.** Patient Demographics (N = 13)

Characteristic	Value
Age (y)	
Mean $\pm$ SD	59.9 $\pm$ 12.3
Range	35–80
INR	
Mean $\pm$ SD	1.5 $\pm$ 0.3
Range	1.1–2.1
Creatinine (mg/dL)	
Mean $\pm$ SD	1.3 $\pm$ 0.7
Range	0.7–2.9
Total bilirubin (mg/dL)	
Mean $\pm$ SD	2.0 $\pm$ 1.5
Range	0.5–6.2
Albumin (mg/dL)	
Mean $\pm$ SD	2.3 $\pm$ 0.5
Range	1.4–3.5
MELD score	
Mean $\pm$ SD	15.2 $\pm$ 5.3
Range	8–26
Sex (male:female)	6:7 (46:54)
Child–Pugh–Turcotte class	
A	1 (8)
B	8 (62)
C	4 (30)

Note—Values in parentheses are percentages.

INR = International Normalized Ratio, MELD = Model for End-stage Liver Disease, SD = standard deviation.

shunt. All patients presented with variceal bleeding within 72 hours of the DIPS procedure, including seven within 24 hours. Three patients required inotropic support, and two underwent the procedure with a Sengstaken–Blakemore gastroesophageal tamponade tube in place.

DIPS creations were performed by using intravascular US guidance with the AcuNav intracardiac echocardiography probe (Acuson/Siemens, Mountain View, California). The technique used is a modification of the procedure described in detail by Petersen and Clark (6). Right jugular 10-F and right femoral 12-F sheaths were telescoped coaxially, and, through a side slit in the femoral sheath, a 65.5-cm, 21-gauge Chiba needle sheathed in a shortened 4-F CXI catheter (Cook, Bloomington, Indiana) was advanced through a Rosch–Uchida cannula (Cook), through the caudate lobe, into the main portal vein. Stent length was prescribed by measuring the tract length by intravascular US and simultaneous portal and caval venography using a calibrated pigtail catheter. A VIATORR device (W. L. Gore & Associates, Flagstaff, Arizona) was used in all patients. Because of acute hemorrhage, coil or plug embolization was performed with the goal of elimination of all variceal blood flow and pressure in all patients. Concomitant variceal sclerotherapy was performed with variceal embolization at the discretion of the operator with the use of a slurry

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