

# Transjugular Intrahepatic Portosystemic Shunt Creation With Embolization or Obliteration for Variceal Bleeding

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Variceal hemorrhage is a life-threatening sequela of liver cirrhosis that requires a careful and comprehensive approach to management. Transjugular intrahepatic portosystemic shunt creation with or without variceal embolization or obliteration represents a minimally invasive image-guided intervention used for the management of varices. This review focuses on the role of transjugular intrahepatic portosystemic shunt and embolization or obliteration in the setting of variceal hemorrhage, with an emphasis on the useful aspects of patient evaluation and selection, practical approaches to procedure planning and valuable elements of interventional technique, and clinical outcomes as they pertain to portal venous decompression and variceal embolotherapy.

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## Introduction

In the 4 decades since the conceptual and experimental advent of percutaneous portosystemic shunting by Rösch et al<sup>1</sup> and the first clinical report of minimally invasive portal decompression and variceal occlusion for treatment of variceal bleeding by Colapinto et al,<sup>2</sup> transjugular intrahepatic portosystemic shunt (TIPS) creation and variceal embolization have developed into widely employed and firmly accepted techniques for the management of variceal hemorrhage in patients with cirrhosis.<sup>3</sup> Though commonly used in current clinical practice, these interventions have evolving indications, applications, and evidential support, and can be labor intensive, technically demanding, time consuming, and intellectually taxing pursuits for Interventional Radiology (IR) operators involved in the care of patients with portal hypertension. In order to address such challenges, this article presents an overview of a single IR physician's clinical and technical approach to TIPS creation and variceal therapy—including

strategies, tactics, tips, tricks, pitfalls, and evidence—based on experience gained in having performed numerous such procedures, partaken in clinical research in the field, and appraised the medical literature in this space. This article focuses on the aspects of patient evaluation and selection, procedure technique, and clinical outcomes as they pertain to portal venous decompression and variceal embolotherapy, whereas details of the medical, endoscopic, and surgical management of variceal bleeding, as well as purely oblitative interventional approaches to variceal treatment, are beyond the scope of the current topic, and would not be discussed.

## Clinical Evaluation of the Patient

### History and Physical Examination

Standard historical information related to gastrointestinal bleeding, including onset, character, amount, and time course are relevant. Patients may be screened for symptoms of liver disease—such as jaundice—to help support a variceal bleeding source. Blood transfusion requirements should be noted. Additional historical information that may influence the decision to pursue TIPS includes number of prior variceal bleeding events, history of hepatic

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encephalopathy, and history of heart failure or pulmonary hypertension. Physical examination should include an assessment of the hemodynamic status of the patient, although findings such as ascites may be germane.

## Endoscopic Evaluation

At the author's institution, all patients with cirrhosis who newly present with gastrointestinal bleeding undergo endoscopic evaluation. Performance of endoscopy is vital to: (1) confirm a variceal bleeding source as opposed to hemorrhage from an arterial cause, as patients with cirrhosis are also at increased risk for peptic ulcer bleeding<sup>4</sup> for which interventional management centers on arterial embolotherapy rather than portal decompression (Fig. 1), (2) define the actively or recently bleeding variceal site or bed based on finding such as nonpulsatile spurting, oozing, adherent clot, or a red wale sign,<sup>5</sup> (3) apply endoscopic band ligation or sclerotherapy in appropriate circumstances, and (4) delineate variceal anatomy based on enteral location as esophageal varices (EVs), gastroesophageal varices, or isolated gastric varices.<sup>6,7</sup> Speaking to the last point, awareness of variceal type has significant implications for the technical approach to interventional management because different varices exhibit unique physiological behaviors as well as distinct perfusion and drainage patterns that may influence the particular therapeutic approach applied. For example, EVs are usually solely supplied by the left gastric vein<sup>8</sup> (Fig. 2), show "uphill" systemic venous drainage<sup>8</sup> (Fig. 3), and are routinely well addressed by TIPS alone, whereas gastric varices (GVs) may be fed by posterior gastric and short gastric veins in addition to the left gastric vein (ie, have more complex anatomy)<sup>8</sup> (Fig. 4), more commonly show "downhill" systemic venous outflow<sup>8</sup> (Fig. 5), and may not

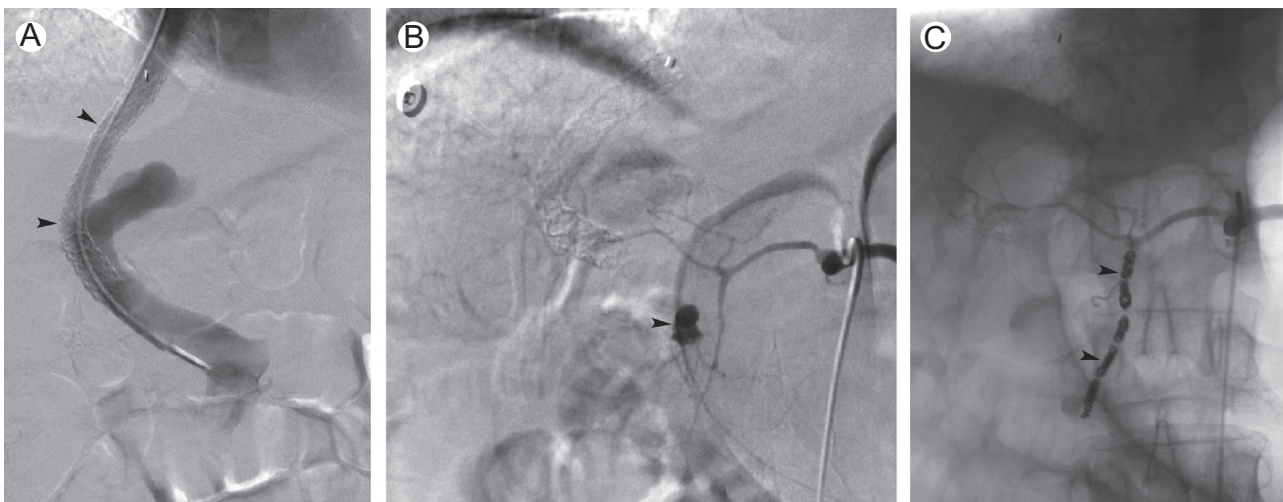
decompress as well following TIPS alone, mandating adjunctive embolization or obliteration.

## Laboratory Testing

Laboratory assessment allows preprocedure risk stratification using accepted liver disease scoring schemes, of which the Model for End Stage Liver Disease (MELD) score is the pre-eminent system for prediction of TIPS mortality outcomes after both elective and emergent TIPS.<sup>9-14</sup> This objective, statistically founded, and liver-specific mathematical metric are based on bilirubin, international normalized ratio, and creatinine laboratory values, and MELD scores performed at the time of TIPS creation have high predictive capability for early patient mortality.<sup>13</sup> At the author's institution, the MELD score is used for both patient selection and as a framework for discussion of anticipated postprocedure clinical outcomes during the informed consent process. From a hematologic standpoint, a platelet count  $\geq 50 \times 10^3/\mu\text{L}$  and international normalized ratio  $\leq 1.5$  are optimal.

## Radiologic Imaging

Preprocedure cross-sectional imaging with computed tomography, magnetic resonance imaging, or ultrasound with color Doppler imaging is vital before TIPS creation,<sup>15</sup> and is routinely obtained by the author. Cross-sectional imaging assessment of the size and morphology of the liver (Fig. 6), the anatomy, size, and patency of hepatic venous and portal venous systems (Fig. 6), and the spatial relationship between hepatic vascular structures (Fig. 6) allows for methodical preprocedure planning. Furthermore, variceal feeding and draining vein anatomy may be mapped out and measured for possible embolization or obliteration. In cases of emergent TIPS in which there is not ample opportunity for formal cross-sectional imaging, preprocedure performance of



**Figure 1** Importance of endoscopic verification of bleeding source. A 73-year-old man with alcoholic cirrhosis transferred from outside hospital with reported variceal bleeding. Hemorrhage from variceal source not endoscopically confirmed at author's institution, and (A) right portal vein to right hepatic vein TIPS (arrowheads) created with PSG reduction from 22 to 7 mm Hg. Patient suffered persistent bleeding post-TIPS, and endoscopy revealed duodenal ulcer source, prompting mesenteric arteriography. Celiac arteriogram (B) demonstrated active gastroduodenal artery bleeding (arrowhead), which was successfully treated with coil embolization (arrowheads).

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