

Complications During Transjugular Intrahepatic Portosystemic Shunt Creation

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Transjugular intrahepatic portosystemic shunt (TIPS) creation is a widely adopted treatment for complications of portal hypertension, including variceal hemorrhage and refractory ascites. The creation of a TIPS requires establishing a pathway from the portal vein to a hepatic vein or inferior vena cava through hepatic parenchyma, using a stent or stent graft to sustain patency of this pathway. Because it is a technically challenging procedure and patients may be critically ill with severe comorbidities, the risk of procedural complications and mortality is substantial. This article discusses known complications of the TIPS procedure and ways to minimize their occurrence.

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Introduction

Transjugular intrahepatic portosystemic shunt (TIPS) placement is considered to be one of the most technically challenging procedures in Interventional Radiology. The first clinical experience with TIPS was described over 30 years ago.¹ Since that time, a large number of possible complications have been identified. The reported risk for minor complications is 4%, and for major complications 3%.² A large retrospective review found the procedural mortality to be 1.7%,³ which compares favorably with alternatives. The safety of the procedure can be maximized if the operator is aware of the possible complications and how to avoid them or treat them.

TIPS is currently indicated for several different clinical conditions,² including acute variceal hemorrhage that is refractory to endoscopic and medical management, chronic refractory variceal hemorrhage, refractory ascites, hepatic hydrothorax, and symptomatic Budd-Chiari syndrome. The technical aspects of the procedure have been described in detail elsewhere.^{2,4-6} This article focuses on the potential complications of TIPS in relation to the technical steps of the procedure.

Preprocedure

Patient Evaluation and Selection

A complete history, physical examination, and laboratory studies including complete blood count, serum liver enzymes, and coagulation parameters are required before performing a TIPS procedure. Knowledge of the contraindications for TIPS is important to reduce the risk of complications. The American Association for the Study of Liver Disease guidelines list absolute contraindications for TIPS including the presence of congestive heart failure, uncontrolled systemic infection or sepsis, unrelieved biliary obstruction, and severe pulmonary hypertension.⁷ Many of these can be identified or excluded by obtaining a thorough patient history and physical examination. With any history of prior cardiac disease or a history of pulmonary hypertension, cardiology consultation and echocardiography with pressure estimates should be obtained. Patients undergoing TIPS creation have been found to have significant cardiac function changes in the 3–6-month postprocedure period, most of which revert to baseline.⁸ It is therefore important to exclude those patients with underlying severe cardiac dysfunction before TIPS creation. The presence of diastolic dysfunction, which in particular can be seen in patients with hepatorenal syndrome (HRS), should not affect the decision to perform TIPS since there does not appear to be any increase in risk of death.⁹

Although severe coagulopathy can be a relative contraindication for TIPS, correction of the coagulopathy with blood products can usually allow for safe placement of

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TIPS stent. Having blood products including packed red blood cells available in the procedure department during the procedure allows for rapid transfusion in case of any new or ongoing hemorrhage. In some patients, coagulopathy cannot be corrected, for instance due to rapid consumption of products by diffuse intravascular coagulation, and appropriately grave expectations should be set for such patients.

Use of predictive models for survival after TIPS should be standard to estimate overall patient risk before proceeding. Quantitative indices such as the Model for End-stage Liver Disease (MELD), Child-Pugh-Turcotte (CPT), and Acute Physiology and Chronic Health Evaluation II scores (APACHE II) can be used to counsel patients and their families on risk and expectations. It remains controversial which index is most accurately predictive.^{10,11} In patients undergoing elective TIPS creation, the 1-month and 6-month mortality rates were 18% and 39%, respectively, if the MELD score was 18 or greater, and the mortality rate increased to 43% and 74% if the score was 25 or greater.¹¹ Mortality was higher for patients treated for ascites vs hemorrhage, and for patients with nonalcoholic etiology vs alcoholic etiology, suggesting that the MELD score was not comprehensive in its predictive value. Subsequent studies have shown that other factors, including encephalopathy and hyponatremia, affect survival but are not included in the MELD score.¹² All these factors, as well as the known mortality of endoscopic variceal treatment or repeated large-volume paracentesis and the availability of liver transplantation, must be carefully weighed when selecting patients for TIPS in these elective cases. Survival predicted by these indices must also be put in perspective in emergent cases, where survival without TIPS would be measured in hours or days.

Preprocedural Imaging

Preprocedural cross-sectional imaging is instrumental in reducing complications from TIPS. A preprocedural contrast-enhanced computed tomography or magnetic resonance imaging should be pursued in all but the most critical of patients. Imaging provides vital anatomical information that can help reduce procedure time, improve 3-dimensional procedural planning, and allow for identification of potential pitfalls. Patency and sizes of the portal and hepatic veins; presence of inferior accessory hepatic veins; cavernous transformation or other signs of chronic occlusion of the portal vein, patency of the splenic vein; presence of sinistral hypertension; acute portal, splenic, mesenteric, or hepatic venous thrombus; presence of hepatocellular carcinoma and macrovascular invasion; presence of biliary pathology; elevation of the hemidiaphragm; presence of hydrothorax or ascites or both; relative size and positions of the atrophied right and hypertrophied left and caudate lobes; presence and systemic drainage of varices; size of the pulmonary arteries and cardiac chambers; reflux of intravenous contrast into the hepatic veins or inferior vena cava; and hepatic arterial patency are all factors that can be revealed by imaging and

are important to consider to avoid procedural complications. If computed tomography or magnetic resonance imaging is not possible due to patient body habitus or severe illness, other imaging methods have been described, but they have greater limitations.¹³

Antimicrobial Prophylaxis

Preprocedure preparation with prophylactic antibiotics is currently recommended in the guidelines set forth by the Society of Interventional Radiology, though there is no consensus as to which antibiotic to use.¹⁴ There are 2 potential sources for infection—contamination from skin flora and contamination from biliary or enteric flora, either of which can result in infection of the TIPS stent, dubbed “endotipsitis.”^{15,16} Most cases of endotipsitis in the reported literature are from bare metal TIPS stent placement with a reported incidence between 1% and 2%.^{17,18} As a result, with the widespread use of covered stents for TIPS, it is uncertain what the current incidence of endotipsitis is and whether antibiotic coverage for Gram-negative organisms and fungi are necessary, particularly as this entity most commonly occurs at a time long after prophylactic antibiotic coverage has lapsed. Antibiotic coverage for skin flora is typically cefazolin, or in those allergic to it, vancomycin or clindamycin. For coverage of biliary and enteric flora, much wider spectrum coverage is necessary. Even without causing endotipsitis, trauma to hepatic parenchyma can cause transient bilhemia with systemic bacteremia and endotoxemia.

Anesthesia

Though moderate sedation may be used for TIPS in some practices, general anesthesia is often used to increase safety and patient comfort. The TIPS procedure can carry significant technical challenges, as well as hemodynamic changes, fluid shifts, hemorrhage, transfusion of blood products, and use of vasoactive pressors, which can be difficult to manage by the interventionalist. Performing TIPS procedures under general anesthesia allows a dedicated anesthesiologist to manage these complex and frequently critically ill patients, freeing the interventionalist to concentrate on the technical aspects of the procedure.¹⁹ If moderate sedation is used, anticipation of the most painful portions of the procedure may allow for deeper sedation during these segments.

Procedure

TIPS placement typically begins with percutaneous access of the internal jugular vein. The right internal jugular vein is usually used, but the left internal jugular vein can be used for select cases such as when the right is occluded,²⁰ and can sometimes provide a more advantageous angle. Puncture of the carotid or subclavian artery, pneumothorax, and puncture of other cervical structures are all potential risks but are rare when using ultrasound guidance for venous access.^{21,22}

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