Transjugular Intrahepatic Portosystemic Shunt: Current Status

THOMAS D. BOYER
Liver Research Institute, Department of Medicine, University of Arizona College of Medicine, Tucson, Arizona

The transjugular intrahepatic portosystemic shunt (TIPS) was developed in the 1980s for treatment of complications of portal hypertension. Once it was shown that the shunt could be placed with relative ease, TIPS was rapidly applied to the treatment of many of the complications of portal hypertension. These complications include actively bleeding gastroesophageal varices, prevention of rebleeding from varices, control of refractory cirrhotic ascites and hepatic hydrothorax, and treatment of hepatorenal failure and hepatopulmonary syndrome. TIPS has also been used as therapy for Budd–Chiari syndrome and veno-occlusive disease. Despite these broad applications, TIPS has been compared with other forms of therapy in only 2 situations: prevention of rebleeding from varices and control of refractory cirrhotic ascites. In the trials, TIPS was shown to provide better control of these 2 complications of portal hypertension than standard forms of therapy. However, there was no improvement in survival and the incidence of encephalopathy was greater for patients receiving a TIPS. Thus, the use of TIPS for the control of ascites and prevention of rebleeding from varices should be limited to a select group of patients. There have been no controlled trials for the other indications listed. Despite the apparent efficacy of TIPS in many of these situations, its use should be limited to salvage therapy pending the publication of controlled trials showing it is a better treatment than other forms of therapy.

The portal vein begins in the capillaries of the intestines and ends in the hepatic sinusoids. In addition to providing a route of egress for the venous blood of the intestines, the portal vein contains substances that are essential to the normal functioning of the liver. Removal of portal venous inflow, as seen following placement of a total surgical portosystemic shunt, is associated with an increased incidence of hepatic failure in patients with cirrhosis. In addition, the incidence of encephalopathy is increased after placement of a total shunt. The previous 2 observations led to the development of surgical shunts that preserve portal venous blood flow to the liver. Despite these adverse events, portosystemic shunts (both total and selective) were the treatment of choice for bleeding varices in the 1980s. Since then, the management of the complications of portal hypertension and especially bleeding varices has changed dramatically. There are now effective pharmacologic and endoscopic treatments for the control of acutely bleeding varices as well as for the primary and secondary prevention of bleeding from gastroesophageal varices. However, treatment of other complications of portal hypertension such as ascites and hepatorenal syndrome have advanced at a much slower pace. Thus, the complications of portal hypertension remain a major cause of morbidity and mortality in patients with cirrhosis.

In 1969, Rösch et al. introduced the idea of creating an intrahepatic shunt. This transjugular intrahepatic portosystemic shunt (TIPS) was used in patients with bleeding varices with rather poor results. Subsequently, the use of an expandable metal stent to ensure long-term patency led to the widespread use of TIPS for the management of variceal bleeding. Newer applications of TIPS include the control of refractory ascites and treatment of hepatic hydrothorax, Budd–Chiari syndrome, and veno-occlusive disease as well as attempts to improve the hepatopulmonary and hepatorenal syndromes. In this report, only the indications for the treatment of complications of cirrhosis are reviewed. Only 2 indications (secondary prophylaxis of varices and treatment of refractory ascites) have been subjected to controlled trials; therefore, the efficacy of the other indications is much less clear. For the indications that have not been subjected to controlled trials, one can decide if performance of a TIPS is safe and possibly efficacious but cannot conclude that the procedure is superior to other forms of therapy.

**Technique**

An interventional radiologist places the TIPS. It is a side-to-side portacaval shunt that connects the portal and hepatic veins within the hepatic parenchyma (Figure 1A and B). TIPS can be performed electively or in an emergency situation. The latter ability provides a signif-

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**Abbreviation used in this paper:** TIPS, transjugular intrahepatic portosystemic shunt.

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A significant advantage over emergency surgical shunts for variceal bleeding, because the mortality associated with emergency surgery is quite high.14 In addition, a TIPS does not alter the portal vein anatomy, which is an advantage if the patient subsequently undergoes liver transplantation.12,13

A TIPS may be performed using either conscious sedation or general anesthesia. If the procedure is going to be prolonged or is performed on an actively bleeding patient, then general anesthesia is preferred to provide airway protection and to make it more comfortable for the patient. Preceding the performance of the TIPS, Doppler ultrasonography should be performed to document the patency of the portal vein. Use of ultrasonography during the procedure may reduce the risk of complications.14

A catheter is inserted via the jugular vein past the right atrium and into the hepatic veins. A needle is then inserted into the hepatic parenchyma, and contrast or CO₂ is injected as the needle is slowly withdrawn. When a branch of the portal vein is identified, a wire is inserted into the vein followed by a catheter. Pressures are obtained, and portography is performed (Figure 1A). A tract within the hepatic parenchyma is then created using a balloon and a stent deployed (Figures 1B and 2). The most commonly used stents are balloon expandable (Palmaz; Johnson & Johnson, Piscataway, NJ) or self expanding (Wallstent; Boston Scientific, Natick, MA). New coated stents that seem to reduce the risk of thrombosis are being developed.15 The therapeutic goal of a TIPS was originally to lower the transhepatic pressure.

Figure 1. (A) Portogram following catheterization of the portal vein. The catheter is seen to pass from the hepatic vein (closed arrow) through the liver substance and into the portal vein (open arrow). Note that there is good filling of the intrahepatic branches of the portal vein. (B) Portogram following placement of the TIPS. Contrast can be seen in the portal vein (closed arrow) flowing through the shunt (curved arrow) and into the hepatic vein (open arrow). Note that there is no visualization of the intrahepatic branches of the portal vein, showing that a TIPS is a total shunt.

Figure 2. The balloon that creates the connection between the hepatic and portal veins has been inflated.
gradient to <12 mm Hg. However, this concept has recently been questioned. In one series, the risk of rebleeding was 18%, 7%, and 1% when the reduction of the initial pressure was 0%, 25%–50%, and >50%, respectively.16 Thus, if the reduction in pressure is >50% of the initial pressure, then adequate decompression has been achieved. Other studies suggest that only a 20% reduction is adequate.17 This latter finding is similar to what has been observed with pharmacologic therapy in that a decrease in the hepatic/portal vein gradient to <12 mm Hg or by 20% is associated with a significant reduction in the risk of rebleeding from varices.2,18 Placement of parallel stents is one approach to achieve an adequate reduction in pressure. Embolization of varices may also be performed in concert with performance of the TIPS to reduce the risk of bleeding in the immediate postoperative period (Figure 3A and B).11,12 Once the TIPS has been placed, the patient requires careful observation during the next 12–24 hours for evidence of intraperitoneal bleeding. Doppler ultrasonography should be performed the day after the procedure to document patency. In my experience, low-grade fever is common 24–48 hours after the procedure and is not indicative of a bacterial infection. Increases in serum aspartate aminotransferase and alanine aminotransferase levels may also be observed in the immediate postprocedural period but quickly return to baseline values in most cases. More serious complications are discussed in the following section.

Complications

The complications of TIPS are numerous; in this report, only the most common complications are discussed (Table 1). A more thorough discussion of complications may be found in other reviews.4,19

Mortality

TIPS can be placed successfully in more than 90% of patients. Procedure-related mortality rates are ~1%, although the 30-day mortality rate may be as high as 55%.11–14 Mortality rates at 1 year for patients undergoing placement of a TIPS for bleeding varices vary from 10% to 52%; when the indication for a TIPS is refractory ascites, the mortality rates at 1 year are 24%–54%.20–23 The severity of the liver disease seems to be the most important variable because mortality rates are the same for patients with the same Child’s score irrespective of the indication for the procedure.21 To better decide which patients are likely to do poorly following placement of a TIPS, several models have been developed.20–23 In one model, total serum bilirubin level, international normalized ratio for prothrombin time, serum creatinine level, and cause of cirrhosis were used to predict survival following placement of a TIPS. A formula was developed (3.8 loge [Bilirubin (mg/dL)] + 11.2 loge [International Normalized Ratio] + 9.6 loge [Creatinine (mg/dL)] + 6.4 [Etiology: 0 if cholestatic or alcoholic and 1 otherwise]) that was found to accurately predict post-TIPS survival.22 This model has now been modified and is used to stratify patients awaiting liver transplantation. In a second study, the variables of bilirubin level >3.0 mg/dL, alanine aminotransferase level >100 IU/L, pre-TIPS encephalopathy, and urgency of TIPS were found to be

Figure 3. (A) The arrow is pointing to a large gastric varix that is flowing into a spontaneous splenorenal shunt. The catheter lies in the short gastric veins via the splenic vein. The patient had bled from the gastric varices. (B) The gastric varices were embolized using coils (arrow), and flow into the varices is no longer present.
independent predictors of survival. Each variable was given a weighted point value, and patients were divided into 3 groups (high-risk, 4–5 points; medium-risk, 1–3 points; low-risk, 0 points). The survival of the 3 groups is shown in Figure 4. In a more recent study, 60-day mortality was dependent on bilirubin level, APACHE II score, and TIPS urgency. Thus, the short- and long-term prognosis for a patient undergoing a TIPS can be predicted with some accuracy. This information should be used to decide about referral to a transplant center, as well as to make decisions about the use of TIPS or an alternative form of therapy.

TIPS Dysfunction

Thrombosis. Thrombosis of a TIPS is usually an early event and occurs in about 10%–15% of patients in the immediate postoperative period. Leakage of bile into the shunt may predispose to the development of thrombosis. Heparin can be used to reduce the risk of thrombosis, but the risk of bleeding is significant in patients with cirrhosis. In a controlled trial, anticoagulation did not reduce the risk of early occlusion and did not decrease the later risk of stenosis. If an acute thrombosis is found, the radiologist can frequently reestablish patency. There is a risk that the clot will be dislodged, leading to a pulmonary embolus. In my experience, the higher figure is more reflective of the true incidence of shunt stenosis and the variable results are a reflection of the tests used to identify the stenosis. For example, Doppler ultrasonography has a variable sensitivity and specificity that ranges from 70% to 100% in the diagnosis of shunt stenosis. Shunt stenosis is common; therefore, the positive predictive value is high but the negative predictive value is low. Abnormal findings on Doppler ultrasonography in a patient with a TIPS should lead to angiography. However, normal findings on ultrasonography in a patient with clinical evidence of TIPS dysfunction should not be used as an argument against the performance of TIPS angiography because the ultrasound may be misleading in this situation. The finding of recurrent varices on endoscopy following a TIPS should also lead to angiography because varices disappear rapidly with a functioning TIPS. Whether TIPS angiography should be performed in the absence of evidence of TIPS dysfunction is controversial. About 80% of patients will develop TIPS dysfunction in the first year after the procedure and may present with bleeding varices or recurrent ascites. Therefore, I suggest the following approach. Doppler ultrasonography should be performed 12–24 hours after the TIPS is placed and then every 3 months following discharge. If ultrasonography suggests TIPS dysfunction or there is a recurrence of a complication of portal hypertension, then TIPS angiography with measurement of mortality in patients with advanced cirrhosis after transjugular intrahepatic portosystemic shunting. Gastroenterology 2000;118:138–144.

<table>
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<tr>
<th>Table 1. Complications of TIPS</th>
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<td>Complications</td>
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<td>TIPS dysfunction</td>
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<tr>
<td>Thrombosis</td>
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<td>Occlusion/stenosis</td>
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<td>Transcapsular puncture</td>
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<td>Intraproitoneal bleed</td>
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<td>Fistulae</td>
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<td>Sepsis</td>
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<td>Encephalopathy</td>
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<td>New/worse</td>
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Data from Boyer and Vargas and Rössle et al.
of pressures should be performed. At the end of the first year, the TIPS should be catheterized to document patency and continued decompression of the portal vein. If stenosis is identified, the TIPS should be dilated and decompression restored. Continued monitoring of the TIPS is required for the life of the patient or until they undergo transplantation.

**Puncture and Fistulae**

During the placement of a TIPS, the liver capsule is frequently punctured. This is especially true if the liver is small. Fortunately, intraperitoneal bleeding is infrequent (1%–2% of cases). Fistulae may develop between the portal vein and an intrahepatic artery. This condition is suspected when the flow in the TIPS is pulsatile and can be managed by embolization of the fistulae. A fistulous tract between the TIPS and the biliary tree may lead to jaundice and sepsis. If this occurs, the TIPS may require occlusion and creation of a new shunt at an alternative site within the liver.

**Hemolysis**

Hemolysis following placement of a TIPS is important to recognize because it may manifest as jaundice and, if not identified, may lead to the mistaken belief that the patient’s liver disease is worsening. The diagnosis is based on the findings of a decrease in hemoglobin, an increase in reticulocyte count, a decrease in haptoglobin levels, and the absence of autoimmune markers of hemolysis. Hemolysis may develop in 10%–15% of patients and usually resolves within 3–4 weeks of TIPS placement as the TIPS becomes covered with a neointimal coating.

**Infections**

Patients with cirrhosis are at increased risk for bacterial infections and sepsis. Although the presence of a TIPS does not seem to alter this risk, a unique type of infection termed “endotipsitis” can occur in patients with a TIPS. This condition should be suspected when the patient develops fever, tender hepatomegaly, and positive blood cultures in the presence of a thrombus or vegetation in the TIPS. Treatment with antibiotics will usually resolve the infection, but the duration of treatment should be prolonged because this is similar to any infection in a vascular endoprosthesis.

**Hepatic Encephalopathy**

The 2 complications of TIPS that limit its widespread acceptance are occlusion or stenosis of the shunt and the development of hepatic encephalopathy. Hepatic encephalopathy is a known complication of a surgical side-to-side shunt, and it is not surprising that it is also a complication of TIPS. The incidence of new or worse encephalopathy is 20%–31%. Although there is not much information about what happens to these patients when they develop encephalopathy, most seem to respond to medical therapy; it is the rare patient (~5%) who requires occlusion of the TIPS to control the encephalopathy.

**Indications for the Use of TIPS**

The indications for TIPS have increased since the procedure was first introduced. Many of the studies describing outcomes following placement of a TIPS are descriptive and have not compared TIPS with alternative forms of therapy. In 2 situations, the efficacy of TIPS has been compared with alternative forms of therapy in controlled trials. Although the latter approach to assess efficacy is preferred, there are conditions (such as acutely bleeding varices refractory to medical management or refractory hepatic hydrothorax) for which alternative therapies are lacking or of poor efficacy. In this review, the efficacy of TIPS in the management of most but not all of the complications of cirrhosis listed in Table 2 are discussed. The other indications for TIPS listed in Table 2 are reports of small retrospective series and are not discussed. TIPS is not indicated for the primary prevention of variceal bleeding. Prophylactic surgical shunts increased mortality compared with untreated controls when used previously in this patient population, and a similar outcome would be expected with TIPS.

**Acutely Bleeding Varices Refractory to Medical Treatment**

Management of the acutely bleeding patient has become easier, and most bleeding can be controlled with a combination of pharmacologic and endoscopic

<table>
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<th>Table 2. Indications and Efficacy of TIPS</th>
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<td>Determined by controlled trials</td>
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<tr>
<td>Secondary prevention of variceal bleeding</td>
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<td>Refractory cirrhotic ascites</td>
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<td>In the absence of another therapy</td>
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<td>Refractory acutely bleeding varices</td>
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<td>Portal hypertensive gastropathy</td>
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<td>Gastric antral vascular ectasia</td>
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<td>Refractory hepatic hydrothorax</td>
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<td>Hepatorenal syndrome</td>
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<td>Type 1</td>
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<td>Type 2</td>
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<tr>
<td>Budd-Chiari syndrome</td>
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<td>Veno-occlusive disease</td>
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<td>Hepatopulmonary syndrome</td>
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therapy. However, on occasion, a patient may continue to bleed or rebleed in the hospital despite medical therapy. These patients were previously managed with a Sengstaken-Blakemore tube followed by an urgent surgical shunt. The outcomes were poor, with more than one half of the patients dying postoperatively. TIPS has been used extensively in this situation. As shown in Table 3, the median control of bleeding was 95%, with rebleeding in 18% and death in 38% of patients. The difficulty with TIPS in the actively bleeding patient is that mortality is quite high. It is the urgency of the TIPS that seems to be the reason for the high mortality, probably because some patients are too ill and will die no matter what intervention is used. In one report, 6 independent variables were combined into a prognostic index that was predictive of death following TIPS. A prognostic index value of >18.5 was predictive of 100% early mortality. Some have recommended limiting the use of TIPS for the emergency control of bleeding to patients who are not ventilated for aspiration, are not septic, and are not receiving drugs to support their blood pressure. However, other groups have not found single or multiple variables to be predictive of early mortality in the acutely bleeding patient. The poor prognosis of the patient should be taken into consideration when deciding whether or not to place a TIPS in this clinical situation.

Secondary Prevention of Variceal Bleeding

It is in the prevention of rebleeding that the efficacy of TIPS has been most extensively studied and compared with other forms of therapy. There are at least 14 controlled trials in which TIPS has been compared with endoscopic and pharmacologic therapy. Table 4 shows the meta-analysis of 11 of these trials involving 811 patients in which TIPS was compared with endoscopic therapy. There was significantly less bleeding in the group treated with TIPS compared with endoscopic therapy; however, the incidence of new encephalopathy was greater in the TIPS group and survival was unaffected. More recent studies comparing band ligation of varices with TIPS have reported similar results. TIPS has also been compared with pharmacologic therapy. In one series, 47 patients were randomly assigned to receive TIPS and 44 were treated with propranolol and oral nitrates. Rebleeding was observed in 13% of the TIPS-treated patients and 39% of those who received pharmacologic treatment. Encephalopathy was more frequent in those receiving a TIPS. Two-year survival was the same in both groups, and liver function was more likely to improve in those receiving drug therapy.

Based on these studies, it can be concluded that placement of a TIPS decreases the rebleeding rate but at the cost of more encephalopathy and no improvement in survival. In addition, a cost analysis of TIPS versus endoscopic therapy found that the cost of TIPS was significantly greater at 12 and 18 months compared with endoscopic therapy. Also, in the comparison of pharmacologic therapy with TIPS, the costs associated with TIPS were twice that of the group treated with medication. Much of the additional cost associated with the use of TIPS is the high occlusion rate leading to the need for monitoring and reintervention. If the need for reintervention can be reduced, then TIPS may be more cost-effective. The development of coated stents may eventually reduce the cost of TIPS. Currently, due to possibly higher cost, the lack of effect on survival, and the increase in the incidence of encephalopathy, TIPS should be considered for the prevention of rebleeding only in patients for whom other therapies have been unsuccessful. Lastly, when TIPS was compared with a surgical shunt, the incidence of shunt dysfunction and rebleeding was greater with TIPS. Thus, even in a situation in which pharmacologic and endoscopic therapies have failed, a surgical shunt may be a better alternative than a TIPS if the patient has good liver function. More study is required before the preferred approach for this select group of patients is certain.

Portal Hypertensive Gastropathy, Gastric Antral Vascular Ectasia, and Gastric Varices

The efficacy of TIPS in the control of bleeding from portal hypertensive gastropathy and gastric antral

| Table 3. Efficacy of TIPS in Treatment of Acutely Bleeding Varices |
|-----------------------------|-----------------------------|-----------------------------|
| No. of patients | Control of bleeding (%) | Median (range) | Mortality (%) |
|-----------------------------|-----------------------------|-----------------------------|
| 248 | 95 (89-100) | 18 (7-30) | 38 (27-55) |
| Data from Burroughs and Patch.

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<th>Table 4. Meta-analysis of TIPS Versus Endoscopic Therapy in the Prevention of Rebleeding From Esophageal Varices</th>
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<td>Rebleeding (%)</td>
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<tr>
<td>TIPS</td>
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<td>19</td>
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| NOTE. The percentage is the number of patients experiencing the adverse event. 
ET, endoscopic therapy. 
A | Difference between 2 groups significant. 
Data from Papatheodoridis et al. |
vascular ectasia has not been subjected to controlled trials. Efficacy is defined as a reduction in bleeding following placement of a TIPS compared with the rate of bleeding before placement of a TIPS. Patients with portal hypertension due to cirrhosis may bleed from portal hypertensive gastropathy and gastric antral vascular ectasia. Although gastric antral vascular ectasia has been considered a variant of portal hypertensive gastropathy, that idea is most likely incorrect. When TIPS has been used to treat patients with either condition, only those with portal hypertensive gastropathy seem to benefit from portal decompression. Bleeding from gastric antral vascular ectasia was not affected by the placement of a TIPS. TIPS is efficacious in the management of bleeding gastric varices, although no comparison with other treatments, such as tissue adhesives, has been reported.

Refractory Cirrhotic Ascites

Control of refractory cirrhotic ascites is the other indication for TIPS for which efficacy has been determined using randomized, controlled trials. Table 5 shows the results of 4 of these trials in which TIPS was compared with large-volume paracentesis. A total of 264 patients were included in the 4 trials; despite differences in entry criteria, the findings are quite similar. A TIPS was effective in reducing the need for repeated large-volume paracentesis but had no effect on transplant-free survival. The incidence of new or severe encephalopathy was increased in the TIPS groups compared with the paracentesis groups, but the differences were not as dramatic as seen in the studies of the secondary prevention of variceal bleeding. This difference may reflect the fact that patients with refractory ascites have more advanced liver disease and therefore are more at risk for the development of encephalopathy irrespective of the type of treatment received. Of note, there was no consistent improvement in renal function in these studies, although there was a reduced incidence of hepatorenal syndrome in the patients with a TIPS compared with patients treated with paracentesis. Quality of life was unaffected by the type of treatment received. None of the studies determined which approach was more cost-effective. Thus, both TIPS and abdominal paracentesis will provide reasonable control of refractory cirrhotic ascites. Patients who are on a transplant list and likely to undergo transplantation within a few months are probably better managed by large-volume paracentesis, whereas patients with refractory ascites who cannot undergo transplantation may be better served by a TIPS. Lastly, a few patients with ascites and active alcoholic liver disease may improve with abstinence, and delaying placement of a TIPS in this group may be warranted.

Refractory Hepatic Hydrothorax

Ascitic fluid may leak from the abdominal cavity into the pleural space via small holes in the diaphragm, leading to the development of hepatic hydrothorax. Because of the lack of compliance in the thoracic cavity, small amounts of fluid (2–3 L) lead to respiratory embarrassment and shortness of breath. Some of these patients require frequent thoracentesis to control their symptoms despite the use of diuretics and are said to have refractory hepatic hydrothorax. A TIPS has been used in patients with refractory hepatic hydrothorax. Although all of the series are small, most patients improved following placement of a TIPS with either resolution of the pleural effusion or a decrease in the need for thoracentesis. Although TIPS seems to be an effective form of therapy for this condition, its use should be limited to patients with hepatic hydrothorax who require repeated thoracentesis for control of symptoms. Patients with milder disease can be treated with diuretics and an occasional thoracentesis.

Hepatorenal Syndrome

Hepatorenal syndrome is a dreaded complication of cirrhosis because its appearance is associated with an extremely poor prognosis. There are 2 types of hepatorenal syndrome. The first type, often referred to as acute hepatorenal syndrome, is characterized by the abrupt deterioration of renal function in patients with fulminant hepatic failure. The second type, chronic hepatorenal syndrome, is characterized by the gradual decline in renal function in patients with chronic liver disease. Both types of hepatorenal syndrome are associated with a high mortality rate.

Table 5. TIPS Versus Large-Volume Paracentesis in Treatment-Refractory Cirrhotic Ascites

<table>
<thead>
<tr>
<th>Reference no.</th>
<th>No. of patients</th>
<th>Ascites improved (%)</th>
<th>Survivala (%)</th>
<th>New or severe encephalopathy (%)</th>
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<tr>
<td></td>
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<td>LVP</td>
<td>TIPS</td>
<td>LVP</td>
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<tr>
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<td>66</td>
<td>52</td>
<td>57</td>
<td>58b</td>
<td>16</td>
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LVP, large-volume paracentesis.

aTransplant-free survival after 2 years for first 3 studies.

bSignificant difference between 2 groups.
renal syndrome. In type 1, the development of renal failure is rapid (over a 2-week period); in type 2, renal insufficiency develops gradually. There have been several reports of improvement in renal function in patients with refractory ascites with or without hepatorenal syndrome. Improvements included increases in glomerular filtration rate and renal plasma flow, decreases in plasma levels of vasoconstrictors, and improved sodium excretion. However, it remains unclear whether the changes in renal function are associated with a survival benefit because none of the published studies are controlled trials. In one series of 31 patients (14 with type 1 and 17 with type 2 hepatorenal syndrome), the placement of a TIPS was associated with an improvement in renal function and removal of 4 of 7 patients from hemodialysis. However, survival in the patients with type 1 hepatorenal syndrome was poor (64%, 50%, and 20% at 3, 6, and 12 months, respectively). In contrast, survival in those with type 2 hepatorenal syndrome was significantly better following placement of a TIPS compared with the type 1 patients. Patients not receiving a TIPS had an even worse outcome, but the study was not randomized and those not receiving a TIPS had more advanced liver disease. As has been seen with other indications for TIPS, the level of bilirubin before placement of a TIPS was an independent predictor of survival. In my experience, placement of a TIPS in a jaundiced patient with type 1 hepatorenal syndrome is ill advised because patients commonly die of multiorgan failure in the immediate postprocedure period. Patients with refractory ascites, type 2 hepatorenal syndrome, and low levels of bilirubin are most likely to benefit from the placement of a TIPS. Clearly, controlled trials comparing TIPS with alternative forms of therapy such as infusion of octreotide and midodrine are required before the role of TIPS in the management of hepatorenal syndrome is determined.

Conclusions

First, placement of a TIPS can be performed safely and will relieve portal hypertension in most patients. Second, a number of clinical variables have been shown to be independent predictors of a poor outcome following placement of a TIPS. In the actively bleeding patient in whom TIPS is being performed urgently, the presence of jaundice or active pulmonary infection or the need for vasoactive agents to support the patient’s blood pressure are predictors of early death. In the patient undergoing an elective TIPS, the presence of jaundice is predictive of a poor outcome. Third, TIPS has been compared with other forms of therapy in prospective randomized, controlled trials only for the prevention of rebleeding from varices and for the treatment of refractory cirrhotic ascites. In controlled trials, TIPS has reduced rates of rebleeding compared with endoscopic or pharmacologic therapy and led to better control of ascites compared with large-volume paracentesis. However, TIPS has not been shown to offer any survival advantage over other forms of therapy. In addition, the incidence of encephalopathy is higher with TIPS and it has not been shown to be cost-effective. TIPS should be used as a rescue form of therapy for these 2 complications of cirrhosis. Finally, TIPS has been used to treat a number of additional complications of cirrhosis and portal hypertension but, unfortunately, efficacy has not been proven in controlled trials. For conditions such as refractory hepatic hydrothorax, TIPS may be the preferred approach due to the lack of suitable alternatives. However, for other conditions for which alternative forms of therapy are available, such as hepatorenal syndrome, use of TIPS should be considered experimental until further studies have been performed.

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Address requests for reprints to: Thomas D. Boyer, M.D., University of Arizona Health Sciences Center, Liver Research Institute, 245136 AHSC, Tucson, Arizona 85724. e-mail: tboyer@ahsc.arizona.edu; fax: (520) 626-5976.