Transjugular Intrahepatic Portosystemic Shunt: Results and Prognostic Factors in Patients with Post-necrotic Liver Cirrhosis

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Purpose: To evaluate the effectiveness of transjugular intrahepatic portosystemic shunt (TIPS) in the management of gastroesophageal variceal bleeding and predictive factors for long-term survival in patients with post-necrotic liver cirrhosis.

Materials and Methods: A total of 49 patients with post-necrotic liver cirrhosis underwent TIPS over a recent three-year period. Forty-five had a history of hepatitis B viral infection, and four, of hepatitis C viral infection. In all patients, the indication for the procedure was variceal bleeding. Child-Pugh class was A in seven patients, B in 16 and C in 26 patients at the time of the last bleeding. The effectiveness of portal decompression and bleeding control was evaluated. Long-term survival was calculated by the Kaplan-Meier method and predictive factors were analyzed using the Wilcoxon test.

Results: The procedure was technically successful in all cases. The portosystemic pressure gradient decreased significantly from 21.4 ± 6.4 mmHg to 12.0 ± 5.1 mmHg (N=45). Active variceal bleeding was controlled in 34 of the 37 emergency patients. The total length of follow-up was from one day to three and a half years (mean: 383 ± 357 days). Rebleeding developed in 17 patients (35%). Hepatic encephalopathy, either newly developed or aggravated, occurred in 16 (32.7%). The thirty-day mortality rate was 20.4%, and the one-year survival rate was 63.8%. The significant predictive factors for poor prognosis were Child-Pugh class C and post-TIPS hepatic encephalopathy.

Conclusion: TIPS is effective in portal decompression in the patients with variceal bleeding due to post-necrotic liver cirrhosis. The Child-Pugh classification and hepatic encephalopathy after TIPS are considered to be significant predictive factors for long-term survival.

Index Words: Hypertension, portal
Liver, cirrhosis
Liver, interventional procedure
Shunts, portosystemic

Introduction

Transjugular intrahepatic portosystemic shunt (TIPS) has been reported as an alternative to sclerotherapy or surgical portosystemic shunt in the treatment of acute variceal bleeding in liver cirrhosis patients (1-3). In many Asian countries, the majority of liver cirrhosis is due to hepatitis B or C viral infection, while in western countries it is due to alcoholic abuse (4). To our knowledge, there have been few reports of portal decompression using the TIPS procedure in patients with post-necrotic liver cirrhosis. Because of differing etiologies of liver cirrhosis, there
might be differences in procedural techniques, the effectiveness of portal decompression, frequency of rebleeding, and shunt related complications.

In order to evaluate the effectiveness of TIPS in the management of gastroesophageal variceal bleeding and long-term survival in patients with post-necrotic liver cirrhosis, we retrospectively reviewed clinical and radiological data of those patients.

Materials and Methods

Patients

Of 70 patients who underwent TIPS procedure during the three years from June 1991 to April 1994, 49 were suffering from post-necrotic liver cirrhosis. Thirty-four were men and 15 were women; their mean age was 49 years (range, 30 – 69). All patients had a history of between one and nine variceal bleeding episodes (mean 2.9 times). There was endoscopic evidence of esophageal or esophagogastric varices (N = 20; N = 26, respectively). In three patients, only gastric varices were detected. Congestive gastropathy was associated with gastric varices in three, and with esophageal varices in two. The serologic criteria of previous viral infection were positive surface antigen and core antibody for hepatitis B infection, and positive antibody for hepatitis C viral infection. There was evidence of previous hepatitis B viral infection in 45 patients and of hepatitis C viral infection in four. The liver function reservoir at the time of the last bleeding was estimated by the Child-Pugh modified scoring system. Child-Pugh class was A in seven patients, B in 16 and C in 26 patients, and 30 were positive for ascites. Imaging diagnoses including sonography (N = 49), CT (N = 25) and arterial portography (N = 16), were performed to assess liver size, portal vein patency and the presence of associated hepatomas. In all cases, endoscopically confirmed bleeding from esophageal or gastric varices was the indication of TIPS procedure. In these cases, endoscopic sclerotherapy had failed to control the gastric or esophageal varices. The procedure was performed on an emergency basis for active bleeding in 37 patients and was elective in 12. In seven Child-Pugh class A patients, the procedure was performed electively in three patients and on an emergency basis in four, because of active bleeding from esophageal or gastric varices.

Procedure

The right internal jugular vein was punctured at the middle of the right neck. After introducing a 9-F arterial sheath (Cook Bloomington, Ind) into the jugular vein, an angiographic catheter was inserted into either the right or middle large hepatic vein. We punctured blindly with Colapinto needle in the initial stage (N = 31), but in later stages punctures were guided by a fine guide-wire inserted in the right and main portal vein via the percutaneous transhepatic route (N = 12). To demonstrate the portal system, however, we have recently performed superior mesenteric arterial portography (N = 6) with or without transfemoral fine guide-wire in the right hepatic via the celiac artery.

In all 49 cases, the stent shunt was constructed successfully. Shunts were from the right hepatic (N = 35) to the right portal vein (N = 27), to the portal bifurcation (N = 5), or to the left portal vein (N = 3). The shunt was from the middle hepatic (N = 12), to the right portal (N = 10), or to the left portal vein (N = 2) (Fig. 1), or from left hepatic to the left portal vein (N = 2).

Pressure was measured at the main portal vein and hepatic venous pressure was measured through the sheath after pull-back. Portography was performed with a catheter in the splenic and superior mesenteric veins. The balloon was positioned across the parenchymal tract and dilated. In 47 patients we used Wallstent (Schneider, Switzerland). A 7F Wallstent

Fig. 1. Forty-year-old male patient with post-necrotic liver cirrhosis and variceal bleeding. After puncture of left portal vein from middle hepatic vein, portal venography was performed. Multiple gastric varicose veins were revealed (A). After creation of shunt between middle hepatic vein and right portal vein with Wallstent, 10mm in diameter, effective portal decompression was obtained. The portosystemic gradient was 9mmHg (B).
was used. If there was still significant hepatofugal flow into the varices, metallic coil embolization with or without Gelfoam pellets was selectively applied to the varices especially in cases with incomplete portal decompression. To evaluate shunt patency, follow-up duplex sonography was performed every three month.

Data analysis

Technical success was defined as the construction of a stent shunt between the hepatic and portal veins and effective portal decompression with a portosystemic pressure gradient less than 15mmHg after the procedure. Successful bleeding control was defined as cessation of bleeding within 24 hours after TIPS. Rebleeding was defined as a new episode of gastrointestinal hemorrhage occurring more than 24 hours of TIPS. The severity of encephalopathy was graded as 0-N, based on level of consciousness, intellectual function, and neurologic abnormalities (5).

The effectiveness of TIPS for portal decompression and bleeding control was evaluated. Thirty-day mortality and long-term survival were calculated by the Kaplan-Meier method and prognostic factors were analyzed with a pc-SAS 6.04 and an IBM compatible PC.

Various potential prognostic factors such as the Child-Pugh classification (A & B versus C), emergency versus elective basis of the procedure, stent size (8mm versus 10mm), post-procedural hemodynamic data (residual portal vein pressure > 20mmHg versus < 20 mmHg), rebleeding (positive versus negative) and post-TIPS encephalopathy (positive versus negative) were evaluated in terms of the influence of prognostic factors on survival rate. The Wilcoxon test was used for statistical evaluation of the groups.

Results

Portal decompression

Hemodynamic data was available for 45 patients. Portal vein pressure before shunt creation was 29.2 ± 7.0mmHg and the hepatic vein pressure was 7.8 ± 4.7 mmHg after TIPS procedure; these changed to 20.3 ± 6.2 mmHg and 8.3 ± 5.2 mmHg, respectively. The portosystemic gradient improved from 21 ± 6.4 mmHg before the procedure to 12.0 ± 5.1 mmHg after; even in the seven of nine patients with an 8mm stent, the pressure gradient significantly improved from 21.3 ± 4.3 mmHg to 13.0 ± 5.7 mmHg. Coil embolizations for varices that persisted after TIPS were performed in 12 cases, with additional Gelfoam embolization in two. Successful TIPS creation resulted in control of acute variceal bleeding in 34 cases (92%) among the 37 emergency patients. Effective portal decompression with a portosystemic pressure gradient of less than 15mmHg was obtained in 35 of the 49 patients (78%) (Fig. 1).

Rebleeding

Rebleeding occurred in 17 patients (35%) during the follow-up period of three and a half years. Rebleeding started within six months in 15 patients, 8 months later in one case, and 2.2 years later in one case. Follow-up evaluation with transjugular portal venography revealed stent occlusion in both patients; redilation of the shunt tract and shunt surgery were successfully performed in both cases. In six of the 15 patients who experienced rebleeding within six months, this occurred within one month of TIPS. The causes of rebleeding in six cases were pre-existing portal vein thrombosis (N=2), acute thrombotic occlusion (N=1) and unknown etiology (N=3). Of the six, only two were successfully controlled by shunt surgery and endoscopic sclerotherapy. The remaining nine cases (18%) underwent shunt stenosis on transjugular portal venography at the time of rebleeding. In two cases, redilation of the stent shunt with a balloon catheter was successful in controlling the second bleeding. A second Wallstent was inserted into the first stent shunt in two cases, and in two patients a new second stent shunt was created after making a new tract. In three cases surgery was performed to make a splenorenal shunt. In one case, the shunt was occluded due to portal vein thrombosis, and in the remaining two cases, rebleeding developed due to stent occlusion. Two patients underwent sclerotherapy and conservative treatment; in three cases, death ensued due to rebleeding.

Hepatic encephalopathy

Before the procedure, thirteen patients had hepatic encephalopathy, and in 16 cases (32.7%) it was aggravated (N=7) or newly developed (N=9) after creation of the intrahepatic shunt. Various degrees of hepatic encephalopathy were present in 20 patients after the procedure. In ten of these, conservative treatment with lactulose was effective in controlling the symptoms. In six, however, hepatic encephalopathy progressed and death due to hepatic coma ensued within one month.

Other complications

In patients with post-necrotic liver cirrhosis, there were several complications other than hepatic encephalopathy and rebleeding after creation of TIPS. These were acute renal failure (N=2), hemoperitoneum...
catheter was positioned across the tract and the stent was deployed so that it covered the tract and extended 1–3 cm into the hepatic and portal veins. In nine patients, the diameter of the stent was 8 mm and in 42 it was 10 mm. An 8-mm balloon was inserted and inflated in the stent.

Portal vein pressure was measured and if the portal decompression was not satisfactory, a 10 mm balloon (N=1), pulmonary edema (N=1), sepsis (N=1), and progressive hepatic failure (N=4). In the patient with hemoperitoneum, fluoroscopy during the procedure showed extravasation to the peritoneum due to a hepatic capsular puncture; he died three days later.

**Long-term survival**

At the end of May 1994, 24 patients had died, 22 were alive and three were no longer included in survival calculation. None of these patients had undergone a liver transplantation. The three who dropped out had undergone a surgical shunt operation after the failure of effective portal decompression with TIPS. The follow-up period of the 49 patients was from one day to three and a half years (mean 383 ± 357 days). The overall one year survival rate, calculated by the Kaplan-Meier method, was 63.8% and the thirty-day mortality rate was 20.4%. The causes of death were progressive hepatic failure or hepatic coma (N=9), rebleeding (N=9), renal failure (N=2), hemoperitoneum (N=1), sepsis (N=1) and unknown causes (N=2).

**Prognostic factors**

Among many prognostic factors, Child-Pugh class and hepatic encephalopathy were significant. The survival rate of Child-Pugh class A and B patients (mean 633 days) was significantly better than that of Child-Pugh class C patients (mean 279 days), as determined by Wilcoxon analysis (p = 0.0009). The one year survival rate of Child-Pugh class A or B patients was 90.0%, significantly better than the rate of 40.8% for those who were Child-Pugh class C (Fig. 2). The thirty-day mortality rate of Child-Pugh class A or B patients, 4.4%, was significantly lower than the rate of 34.6%, noted for those who were Child-Pugh class C. The survival rate of elective cases was significantly better than that of emergency cases. The presence of hepatic encephalopathy after TIPS, either aggregrated status of preexisting one or newly-developed one, was a significant predictive factor for poor prognosis. The mean survival period of patients without hepatic encephalopathy was 450 days, significantly better than the 289 days of those with this condition (p=0.0093) (Fig. 3). All other potential prognostic factors were not significant (Table 1).

**Discussion**

TIPS has been accepted as a portal decompression procedure in the management of variceal bleeding and the efficacy of the procedure has been proven in various types of liver cirrhosis (1–3). The post-necrotic liver, especially after hepatitis B viral infection, is typically shrunken, distorted in shape, and composed of nodules of liver cells separated by dense and broad bands of fibrosis (6). The right hepatic
Table 1. Variables and Groups in Consideration of Prognostic Factors of TIPS in 49 Patients with Post-necrotic Liver Cirrhosis

<table>
<thead>
<tr>
<th>Variables</th>
<th>N</th>
<th>Grups</th>
<th>P value$^+$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child-Pugh classification</td>
<td>49</td>
<td>I A &amp; B (47%) Class C (53%)</td>
<td>0.0009*</td>
</tr>
<tr>
<td>Endoscopic grade of esophaged varix</td>
<td>49</td>
<td>Grade 0 I (14%) Grade II (29%) Grade III (57%)</td>
<td>0.9833</td>
</tr>
<tr>
<td>Stent diameter</td>
<td>49</td>
<td>8mm (18%) 10mm (82%)</td>
<td>0.9765</td>
</tr>
<tr>
<td>Post-TIPS portal vein pressure</td>
<td>45</td>
<td>$\geq 20\text{mmHg}$ (56%) $&lt; 20\text{mmHg}$ (44%)</td>
<td>0.9445</td>
</tr>
<tr>
<td>Post-TIPS portosystemic gradient</td>
<td>45</td>
<td>$&gt; 12\text{mmHg}$ (42%) $&lt; 12\text{mmHg}$ (58%)</td>
<td>0.8131</td>
</tr>
<tr>
<td>Rebleeding</td>
<td>49</td>
<td>Positive (29%) Negative (71%)</td>
<td>0.2430</td>
</tr>
<tr>
<td>Post-TIPS hepatic encephalopathy</td>
<td>49</td>
<td>Positive (43%) Negative (57%)</td>
<td>0.0093*</td>
</tr>
</tbody>
</table>

$^+$ P value by Wilcoxon method, * statistically significant $< 0.05$

vein sometimes becomes small and narrow due to the shrunken right lobe of the liver. Even with such anatomic distortion, TIPS could be created in all patients with post-necrotic liver cirrhosis. In many Asian countries, liver transplantation has not been widely accepted, so TIPS procedure is used only for the purpose of permanent portal decompression, not for the bridging procedure before a subsequent liver transplant. Long-term survival after TIPS is, therefore, important in these patients.

There have been many reports of successful portal decompression after TIPS that resulted in a significantly lower residual pressure gradient between the portal and hepatic veins (1−3); after successful TIPS, the mean residual portosystemic gradient was usually lower than 12mmHg. In recent TIPS reports, most cases were Laennec’s cirrhosis (1−3). In this series with post-necrotic cirrhosis, a high technical success rate was also obtained. The technique for creating a stent shunt between the hepatic and portal veins was difficult in those cases with severe atrophy of the right lobe due to post-necrotic liver cirrhosis, and the resulting anatomical distortion may have resulted in relatively poor maintenance of the shunt.

Emergency TIPS successfully controlled acute variceal bleeding in all except three patients. The incidence of rebleeding was reported to be between 6.7 and 36% (7); it developed in 17 patients (35%) in our series, mostly within one month of TIPS. The main cause of rebleeding was considered to be restenosis of stent shunt, which was successfully managed in six cases. The relatively high incidence of early rebleeding in our series seemed to be due to coagulopathy in those patients who were Child-Pugh class C.

In addition to hepatocellular carcinoma and bleeding varices, hepatic encephalopathy is one of the serious sequelae of the progressive post-necrotic liver cirrhosis. It is also one of the serious complications of TIPS and its frequency has been reported as being between 5 and 35% (7). In a series of 100 patients, LaBerge et al. reported 17 with new or aggravated hepatic encephalopathy out of a total of 96 patients who had successfully undergone TIPS (2). In our series, the incidence of hepatic encephalopathy was 32.7%, relatively high compared to previous reports. In many of our patients it was most likely due to poor liver function, Child-Pugh class C. Of the 14 patients with new or aggravated hepatic encephalopathy, eight died because of progressive hepatic failure and hepatic coma.

Excluding hepatic encephalopathy and delayed stenosis or occlusion of the stent, the overall complication rate in the report of LaBerge et al. was less than 10%. Complications were related to techniques, stents or contrast media (7). In our series, complications other than hepatic encephalopathy and rebleeding were hemoperitoneum, renal failure, pulmonary edema and sepsis.

We assumed many potential prognostic factors, such as Child-Pugh classification, emergency or elective basis for the procedure, stent size, post-procedural hemodynamic data, rebleeding, and post-TIPS encephalopathy. Of these, Child-Pugh class and hepatic post-procedural encephalopathy were significant prognostic factors in multivariate analysis. In any treatment modality the prognosis of Child-Pugh class C patients is very poor. The reported operative mortality rate associated with surgical portocaval shunts in cirrhotic patients who are Child-Pugh class C is as high as 50% (8). LaBerge et al. reported that the 30-day mortality rate after TIPS was 24% in Child-Pugh class C patients (2). In our series, the survival rate of such patients was very poor with a mean survival period of 279 days; due to hepatic coma, failed bleeding control and other complications, the 30-day mortality rate of Child-Pugh C patients was as high as 34.6%. All except one of such patients underwent the procedure on an
emergency basis.

In summary, TIPS is considered to be effective in portal decompression in patients with variceal bleeding due to post-necrotic liver cirrhosis. The overall one year survival rate after TIPS is 63.8% in patients with post-necrotic liver cirrhosis. During long-term follow-up, it should be considered that the significant prognostic factors are Child-Pugh classification and post-TIPS hepatic encephalopathy.

References