Transjugular Intrahepatic Portosystemic Shunt in Patients with Active Variceal Bleeding Due to Portal Hypertension and Portal Vein Thrombosis

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Purpose: To evaluate the feasibility and efficacy of transjugular intrahepatic portosystemic shunt (TIPS) in patients with active variceal bleeding due to liver cirrhosis and pre-existing portal vein thrombosis.

Materials and Methods: Of a total of 123 patients who underwent TIPS, 14 patients with intractable variceal bleeding due to portal hypertension and portal vein thrombosis were included in this study. Noncavernomatous portal vein occlusion was seen in eight patients, and complete portal vein occlusion with cavernomatous transformation in six. For all patients, the methods used for TIPS placement were the same as those used in patients with patent portal veins. In seven of eight patients with noncavernomatous occlusion, right hepatic vein-right portal vein shunting was performed; in one with noncavernomatous occlusion, a shunt was created between the right hepatic and left portal vein. In five of six patients with cavernomatous occlusion, the right hepatic and main portal vein were connected via a collateral vein.

Results: The procedures were technically successful in all except one patient. Immediate hemostasis was achieved after all technically successful procedures, and no significant complications were encountered. Minor complications were noted in six patients (three biliary tree punctures, one transperitoneal puncture, one splenic vein perforation, one hepatic subcapsular hematoma).

Conclusion: TIPS is a technically feasible and hemodynamically effective procedure, even in patients with active variceal bleeding due to cirrhosis and complete portal vein occlusion.

Index Words: Hypertension, portal
Liver, cirrhosis
Portal vein, thrombosis
Shunts, portosystemic

We evaluated the efficacy and safety of TIPS in the treatment of a series of patients with intractable variceal bleeding due to portal hypertension and portal vein thrombosis.

Materials and Methods

Between August 1991 and April 1997, 123 consecutive patients with liver cirrhosis underwent 145 TIPS placement procedures for the control of variceal bleeding. Fourteen of these, who showed occlusion of the main portal vein, were included in this study. The study group consisted of ten men and four women.
with a mean age of 49.6 (range, 26—74) years. All were treated on an emergency basis and had active esophageal or gastric variceal bleeding that did not respond to repeat endoscopic sclerotherapy. In eight patients there was noncavernomatous transformation and six showed cavernomatous occlusion. On the basis of the Childs-Pugh modified scoring system, two were classified as having Child A disease; five, as having Child B disease; and the remaining seven, as having Child C disease (5). The causes of liver cirrhosis were viral hepatitis in eight patients, alcohol in three, and in three, the etiology was undetermined (Table 1).

The absence of blood flow in the main portal vein, as seen on color duplex sonography, was diagnosed as occlusion; multiple collateral veins in the hepatic porta area were diagnosed as cavernomatous transformation. Conventional gray-scale ultrasound scans demonstrated a solid echotexture within the portal vein with no collateral veins, and this was diagnosed as noncavernomatous obstruction of the portal vein.

In all patients, the methods used for portal vein puncture were essentially the same as those that we have been using in patients with patent portal veins (6). The right internal jugular vein was percutaneously punctured, and a sheath catheter was advanced into the inferior vena cava. The right hepatic vein was then selectively catheterized, and hepatic venography was performed. A Colapinto needle was introduced over a rigid guide wire and advanced to the expected location of the portal vein in the liver parenchyma. Contrast medium was injected, with the needle being slowly withdrawn. After puncture of a portal vein, in cases of noncavernomatous occlusion, a torque-control guide wire (Terumo, Tokyo, Japan) was rotated with gentle forward pressure and scraped along the surface of the portal vein at the point of obstruction. A 5-F catheter was then advanced over the guide wire into the splenic or superior mesenteric vein, and to define the anatomy of the portal venous system, contrast medium was injected. In cases of chronic portal vein occlusion with cavernomatous transformation, a portogram was obtained after catheter placement at the splenic or superior mesenteric vein via a collateral vein.

After puncture of a portal venous branch, balloon dilatation of the resulting intraparenchymal tract was followed by deployment of a metallic stent. If necessary, an additional stent was placed, such that it overlapped the previous one. In cases of cavernomatous occlusion, a stent was placed through a larger collateral vein. Embolization of variceal veins with stainless steel coils (Cook, Bloomington, USA) was performed in four of our patients with residual variceal flow after TIPS creation. In all patients, a self-expanding Wallstents

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<tr>
<th>Patient</th>
<th>Age/Sex</th>
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Note. — HBV=Hepatitis B virus
* = who underwent revision due to shunt occlusion
—R-L= between the right hepatic vein and the left portal vein
—R-C= between the right hepatic vein and main portal vein via a collateral vein
—R-R= between the right hepatic vein and the right portal vein

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(Schneider, Minneapolis, Minn), 10 mm in diameter, were inserted.

In seven of eight patients with noncavernomatous occlusion, right hepatic vein-right portal vein shunting was performed, and in one with noncavernomatous occlusion, the left portal vein was connected to the right hepatic vein. In five of six patients with cavernomatous occlusion, the right hepatic vein was connected to the main portal vein via a collateral vein. The pressure gradient of portosystemic shunt was not measured, and the end-point of TIPS procedure was hemostasis, the presence of markedly decreased variceal veins, and good flow through the shunt.

**Results**

The procedures were technically successful in 13 of 14 patients (92.9%). The splenic portogram obtained immediately after the procedure revealed good function of the shunt and hemodynamically improved features. Immediate hemostasis was achieved after all technically successful procedures. The most difficult step was the puncture of the

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**Fig. 1.** TIPS placement in a 47-year-old woman with noncavernomatous portal vein occlusion and recurrent variceal bleeding.
A. Transjugular portal venogram obtained before TIPS placement shows complete occlusion of the main portal vein and prominent variceal veins.
B. Portal venogram obtained after TIPS placement shows good flow through the shunt and minimal filling of varices.

**Fig. 2.** TIPS placement in a 45-year-old man with cavernomatous portal vein occlusion and recurrent variceal bleeding.
A. Transjugular portal venogram obtained before TIPS placement shows occlusion of the main portal vein and a large collateral vein and prominent variceal veins around the gallbladder (arrows) and stomach (open arrows).
B. TIPS was done through a larger collateral vein (arrows). Portal venogram obtained after TIPS placement shows good flow through the shunt and decreased variceal flow.
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Fig. 3. TIPS placement in a 47-year-old man with cavernomatous portal vein occlusion and recurrent variceal bleeding.
A. Transjugular portal venogram after puncture of the left portal vein shows occlusion of the main portal vein and multiple collateral veins (open arrows).
B. Transjugular splenic venogram via a larger collateral vein (arrows) shows prominent coronary varices.
C. Late phase of the splenic venogram shows prominent gastroesophageal varices (arrow) and mediastinal veins (arrow heads).
D. TIPS placement was done via a larger collateral vein. Portal venogram after TIPS placement shows good function of the shunt and decreased variceal flow.

intrahepatic portal vein branch, which in all patients, was successfully carried out under fluoroscopic guidance. In one patient with complete portal vein occlusion with cavernomatous transformation, TIPS creation failed due to widespread formation. TIPS creation failed due to widespread thrombosis in the portal venous system, including the main portal, splenic, superior mesenteric and inferior mesenteric veins. Even in this case, portal venography after puncture of the portal vein was successful.

Using only the transjugular methods, TIPS were successfully placed in all patients with a soft thrombus in the portal vein. In all eight nocavernomatous occlusion patients, the guide wire passed directly through the clotted segment with very little resistance. In all six with chronic portal vein occlusion and cavernomatous transformation, the occluded segment could not be passed with a guide wire. TIPS creation was successful in five of six of these patients through larger collateral veins (Figs. 1 and 2).

Long term follow up showed rebleeding in one patient after 43 months, due to marked hemodynamically significant stenosis at the proximal end of the shunt tract that resulted in shunt insufficiency. Shunt function was restored by an additional stent, coaxially implanted (Fig. 3).

After the successful implantation of TIPS and during the procedure, no major procedure-related
Discussion

Portal vein thrombosis is considered to be a relatively common complication of liver cirrhosis, irrespective of the cause (7, 8). In the literature, its prevalence has been reported to range from less than 1% to 17% (9–11). It is generally accepted that in patients with liver cirrhosis, the low flow state in the portal venous system is the main predisposing condition for thrombus formation (7–11). Okuda et al (10) reported a higher incidence of portal vein thrombosis among patients with poor hepatic function. Blum et al (12) reported that in 25 of 505 patients (5%) evaluated for TIPS placement, thrombosis of the portal vein system was present. In our series, complete portal vein thrombosis was present in 14 out of the 123 patients (11.4%) referred for TIPS placement.

Therapeutic options for patients with variceal bleeding and portal vein thrombosis have been limited, with endoscopic therapy as the treatment of choice. After this failed, the surgical creation of a shunt was the only remaining option (7, 8). The therapeutic options for decreasing portal pressure gradient, such as creation of a portocaval shunt after thrombectomy, a mesocaval shunt with prosthesis interposition, or a splenorenal shunt, were limited (7, 8, 13). Because widespread thrombosis of the portal vein is common, and many patients are at high risk of the recurrence or onset of bleeding, shunt creation is not always possible (7, 8, 14). The perioperative mortality rate was about 8% (7) and increased during the 6-month follow-up period to more than 50% (8). Because it is performed with local anesthesia and carries a very low risk, TIPS placement in this setting is an attractive alternative.

It has been reported that partial portal vein occlusion does not contraindicate TIPS placement; complete occlusion of the portal vein however, with or without cavernomatous transformation, has been considered a relative or absolute contraindication (1, 15). In these cases, the use of additional transhepatic approaches or combined local fibrinolytic therapy has been reported, with good results (12, 16). The additional transhepatic approach has been reported to provide shorter and more direct access to the peripheral portal venous branches and has been more easily adjusted, if necessary, in order to gain access to a patent peripheral portal branch. This approach also provides a much better angle for guide-wire and catheter manipulation and offers a better line of force for passing catheters through the resistance of a chronically occluded venous segment (16). By means of transjugular access, with or without additional transhepatic approach, Radosevich et al. (16) successfully placed TIPS in seven of 10 patients with complete portal vein occlusion.

The major technical problem in the placement of TIPS in patients with noncavernomatous portal vein thrombosis is the frequent difficulty of advancing the guide wire and catheter through the obstruction. It has been demonstrated that noncavernomatous portal vein occlusion can be treated with TIPS insertion and local fibrinolysis (12). In our series, however, puncture of a portal venous branch and portal venography was possible in all patients, with only the transjugular approach performed under fluoroscopic guidance. All eight patients with noncavernomatous occlusion had a soft thrombus in the main portal vein, and a torque control guide wire could therefore be passed through the occluded portal vein with little difficulty.

Complete occlusion of the portal vein with cavernomatous transformation does not, in principle, however, preclude adequate shunting of blood by means of TIPS. In five of our six patients with this condition, TIPS was successfully created through a collateral vein.

In 13 of 14 patients (92.9%), TIPS placement was successful without the use of additional transhepatic routes or local fibrinolysis. Successful creation of TIPS has been reported in 93 to 100% of the cases in a large series (1–3), and we successfully created TIPS in 107 of 109 patients (98.2%) without portal vein thrombosis. Short-term clinical success in controlling acute or recurrent variceal bleeding has been reported in 81–94% of patients who underwent TIPS (1, 15). In our series successful hemostasis was achieved in 13 of 14 patients with TIPS (92.9%) with or without the use of stainless steel coil embolization of the variceal veins. Our data demonstrated that TIPS is a technically feasible and hemodynamically effective method, even in cases of portal hypertension with portal vein thrombosis.

A few minor complications were observed: three
biliary tree punctures, one transperitoneal puncture, one splenic vein puncture and the formation of one subcapsular hematoma. These were self-limiting, however, and needed no additional treatment, and no major complications related to the procedure were encountered in any of our patients. When an occluded portal vein is recanalized, the possibility of pulmonary embolism has to be considered; we, however, observed no such complications which were clinically significant. such complications. If, on portography, acute soft thrombi were seen, we attempted to displace these in the hepatofugal direction, using a balloon catheter so as to occlude the collateral variceal veins and not to obstruct inflow into the shunt. When creating the shunt, we recorded, unfortunately, no detailed hemodynamic data relating to these patients.

Our experience with these 14 patients suggests that portal vein occlusion with active variceal bleeding does not contraindicate TIPS placement. Successful shunts were established in most patients, and there were no significant complications, even in a patient in whom the procedure was unsuccessful. In patients in whom the creation of TIPS was successful, improved hemodynamics, with immediate hemostasis, was achieved. In conclusion, TIPS is a safe and effective method, even in cases of active variceal bleeding due to liver cirrhosis and portal vein thrombosis.

References

주 간문맥 폐쇄를 동반한 정맥류 출혈 환자에서의 경목정맥 간내문맥-간정맥 단락술

목적: 주 간문맥 폐쇄를 동반한 정맥류 출혈 환자에서의 경목정맥 간내문맥-간정맥 단락술의 유용성과 안전성에 대해 알아보려 하였다.

대상 및 방법: 간경화증으로 인한 정맥류 출혈의 지혈을 목적으로 경목정맥 간내문맥-간정맥 단락술을 시행한 환자 중 주 간문맥 폐쇄가 있었던 14명의 환자를 대상으로 하였다. 해면종성 변화를 동반한 주 간문맥 폐쇄가 8명, 해면종성 변화 없이 주 간문맥의 폐쇄를 보인 경우가 6명이었다. 시술은 문맥 폐쇄가 없는 환자에서의 시술과 동일한 방법으로 하였으며 해면종성 변화를 동반한 환자 중 5명은 우간정맥으로부터 측부 순환 문맥을 통하여 폐쇄가 없는 문맥 또는 비정맥까지 스텐트를 위치시켰다. 해면종성 변화를 동반하지 않은 8명의 환자에서는 우간정맥으로부터 우문맥 (7명) 또는 좌문맥 (1명)을 통하여 폐쇄 부위를 통과하여 단락을 형성시켰다.

결과: 광범위의 문맥계 폐쇄를 보인 1명의 환자를 제외한 13명의 환자에서 기술적으로 성공하였으며 문맥활영술에서 현격한 혈류역학적 호전을 보였다. 모든 환자에서 심각한 합병증은 없었으며 6명의 환자에서 경한 합병증이 있었다.

결론: 경목정맥 간내문맥-간정맥 단락술은 주 간문맥의 폐쇄를 동반한 정맥류 출혈 환자에 있어서도 효과적이고 안전한 시술로 생각된다.
1. 전문의 시험 분야별 출제비율

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2. 핵의학 분야의 수련은 현행대로 2개월 이상 의무적으로 수련해야 하며 전문의 시험에도 핵의학을 현행 비율대로 계속 출제 할 것임.
3. 동위원소 취급 특수면허 취득을 위한 교육이나 동면허취득으로 상기 2항의 수련 의무를 대신하지 못함.
4. 상기 출제 비율은 당해연도 문제 선택위원의 성향 또는 문제은행의 문제 성향 등에 따라 증감될 수 있음.
5. 전공의의 전문의시험 응시자격을 위한 논문은 응시서류 제출시 별책을 제1저자 원저 1편과 공저자 2편을 제출하여야 함(단, 증례보고와 논문개체 확인 증명서는 안됨).