

가

가 50 cm/sec 90 cm/sec
(4 - 6)

가 . 220 cm/sec (1, 2, 5, 6). 185 cm/sec

가

Dodd (3) 가 50 cm/sec
(1 - 3).

(Fig. 1C) 가

가 가
41 cm/sec 42.8 cm/sec
(2, 5, 6). ,

(hepatofugal flow) (Fig. 1D).

가 (Fig. 1E). 가 (7)

Palmaz, Wall
가

(Fig. 1A, B)

가

가

6
hyperplasia) 가 (pseudointimal 1) 50 cm/sec 가
가 가 가 , 2) 60 cm/sec
가 , 3) 가 , 4)

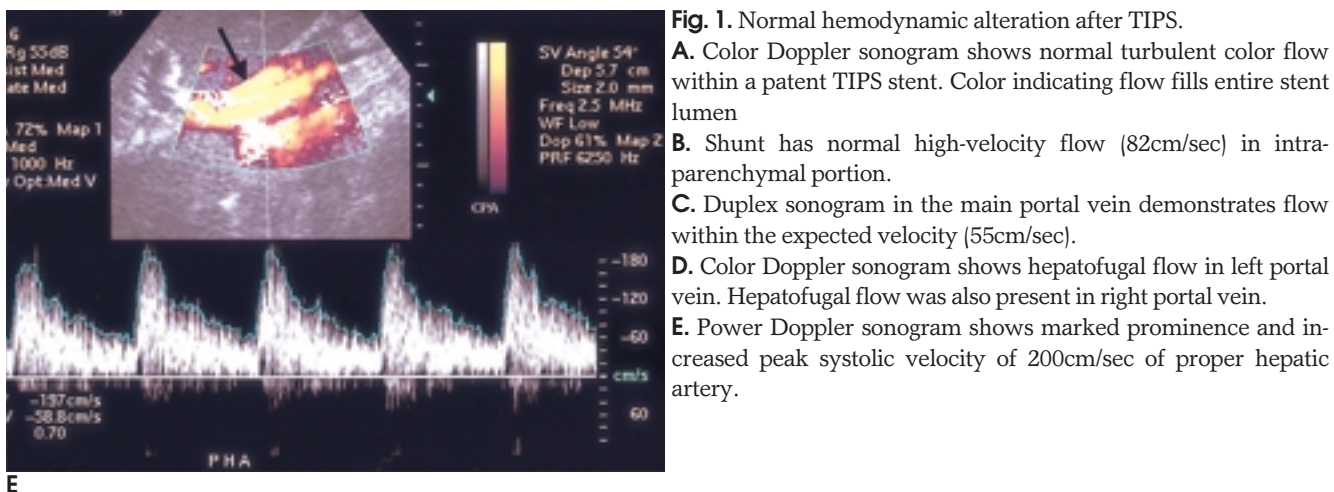
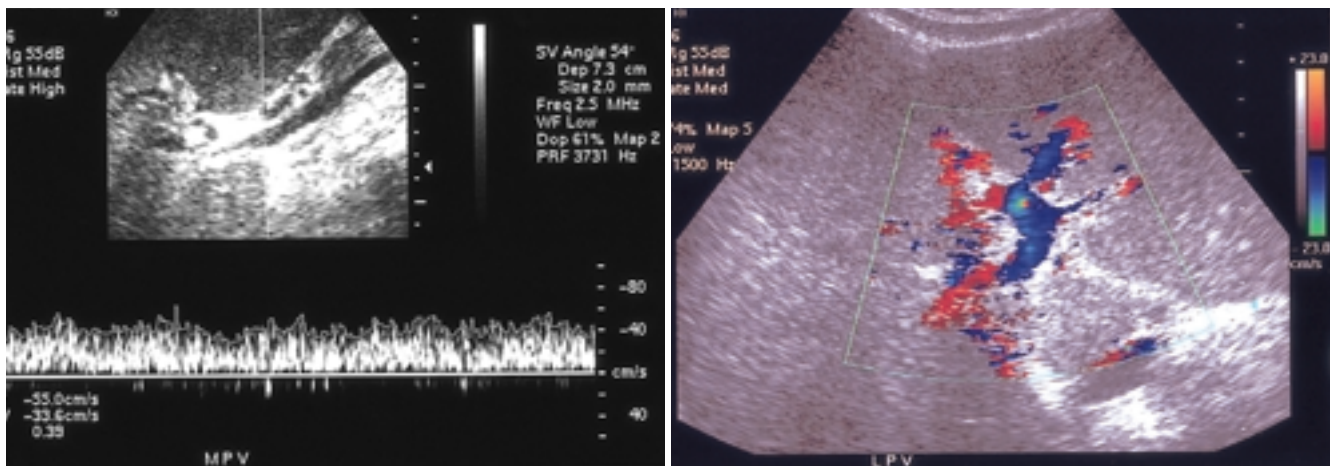
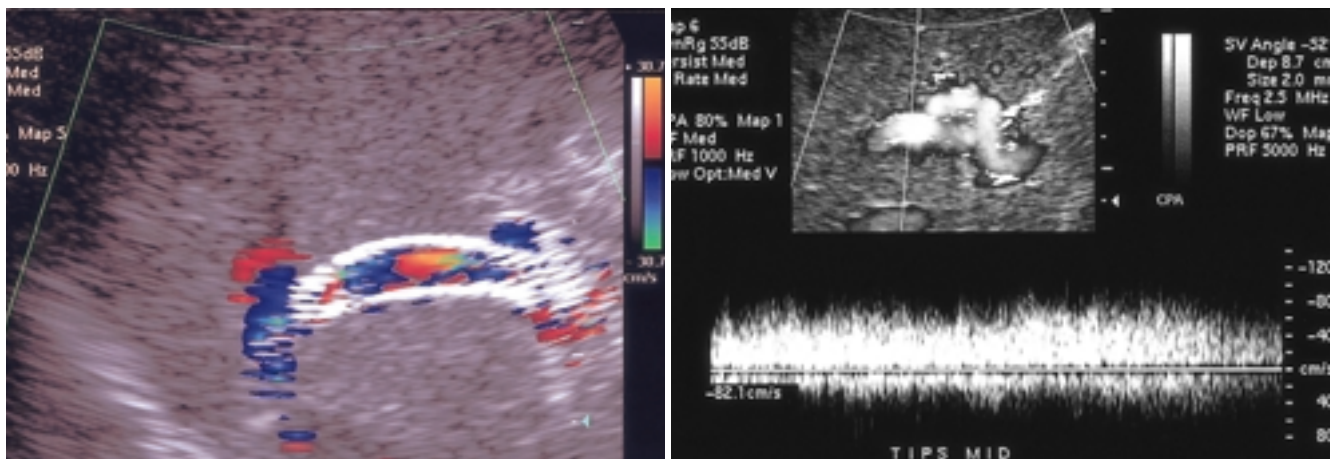


Fig. 1. Normal hemodynamic alteration after TIPS.
A. Color Doppler sonogram shows normal turbulent color flow within a patent TIPS stent. Color indicating flow fills entire stent lumen
B. Shunt has normal high-velocity flow (82cm/sec) in intra-parenchymal portion.
C. Duplex sonogram in the main portal vein demonstrates flow within the expected velocity (55cm/sec).
D. Color Doppler sonogram shows hepatofugal flow in left portal vein. Hepatofugal flow was also present in right portal vein.
E. Power Doppler sonogram shows marked prominence and increased peak systolic velocity of 200cm/sec of proper hepatic artery.

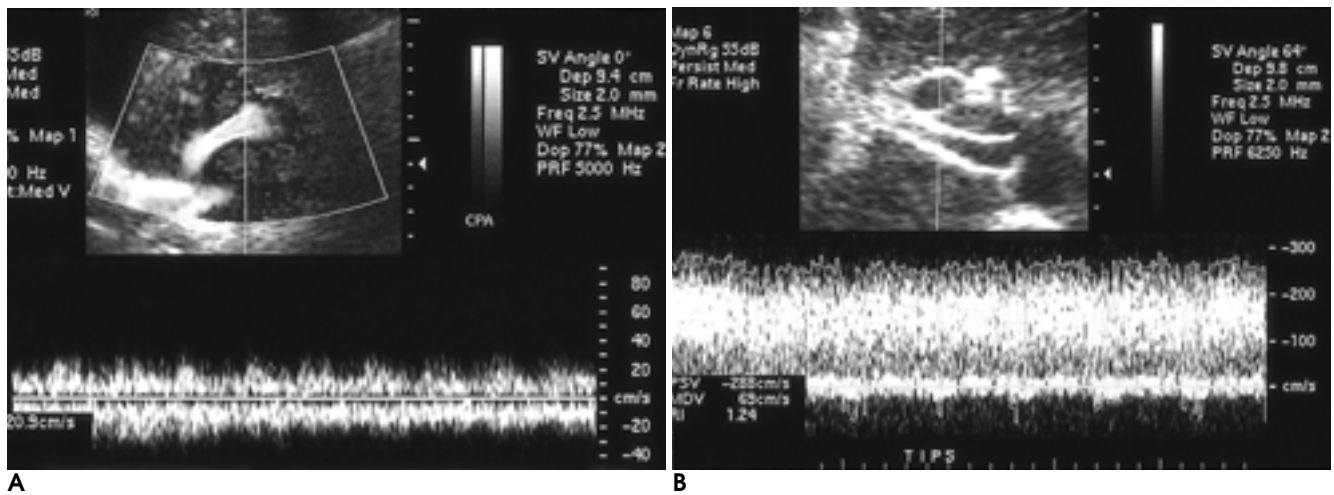


Fig. 2. Focal stenosis at stent.

A. Duplex sonogram of a TIPS shows diminished velocities (20cm/sec) at portal vein side of stent, suggestive of shunt malfunction.

B. Duplex sonogram shows a focal region of elevated velocity (288cm/sec) at hepatic vein side of stent, suggesting a focal stenosis.

C. Angiogram confirms diffuse intimal hyperplasia (small arrows) with a focal critical stenosis (large arrow) at portal vein side of shunt.

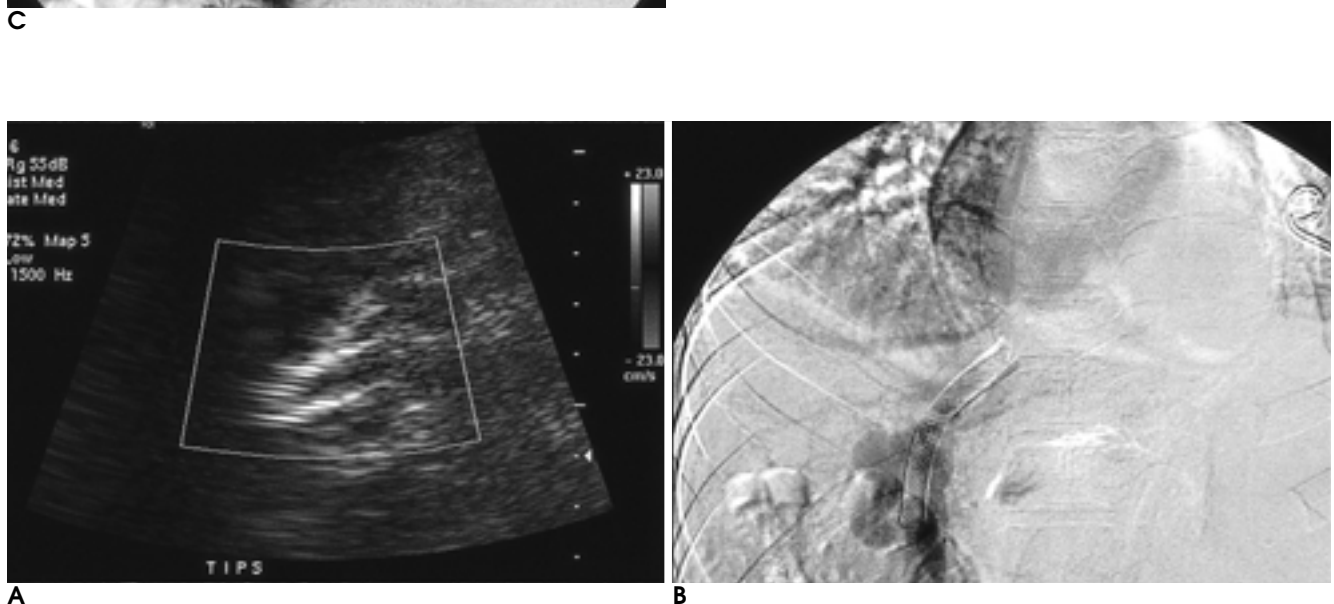


Fig. 3. Stent occlusion after TIPS procedure.

A. Six months after TIPS creation, Doppler sonogram shows absence of flow through a TIPS stent and presence of echogenic material within stent lumen.

B. Angiogram shows complete occlusion of the stent.

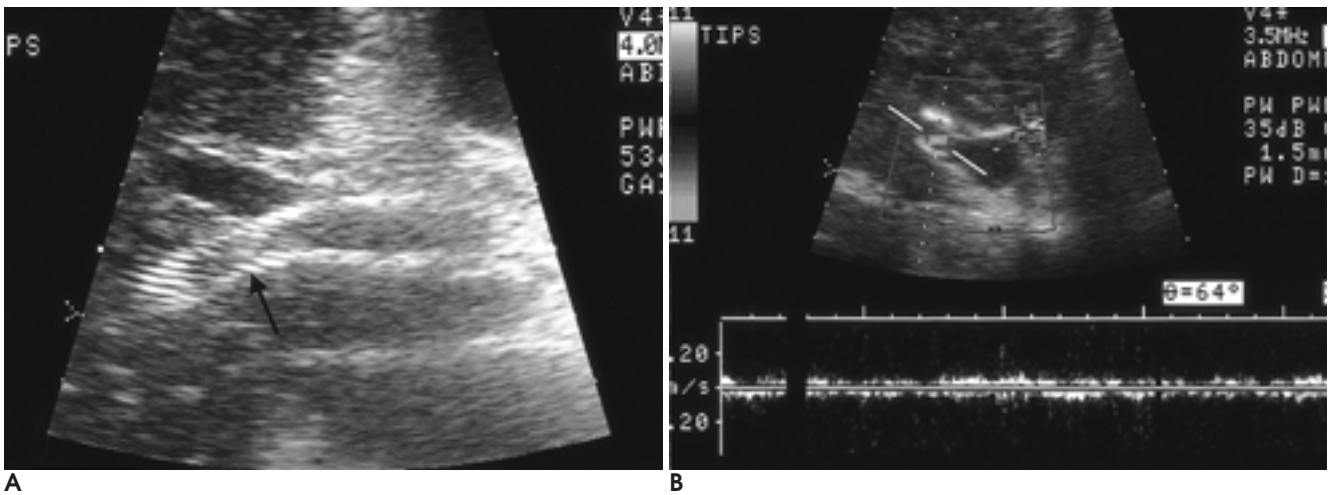
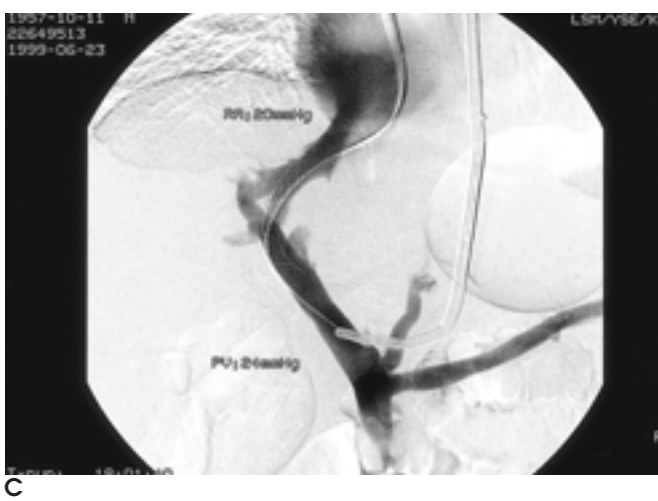


Fig. 4. Pitfall in sonography after TIPS suggesting stenosis.
A. Gray-scale sonogram through a TIPS shows increased echogenicity within stent (arrows), in this case caused by partial imaging of stent wall.
B. Duplex sonogram shows weak flow (below 10cm/sec) through stent.
C. Corresponding angiogram shows patent shunt from portal vein to right hepatic vein without pressure gradient.



(hepatopetal)

가 . 가 (5).

50 cm/sec

가 가 (Fig. 4).

. Dodd (3)

가 50 cm/sec

(6) 100 cm/sec

Kanter - man 3.5 - MHz

가

42 cm/sec

Kanterman (6) 30 cm/sec

82% 77%

(Fig. 3).

가 가 가

- portosystemic shunt: evaluation with Doppler sonography. *Radiology* 1993; 186: 529-534
2. Surratt RS, Middleton WD, Darcy MD, Melson GL, Brink JA. Morphologic and hemodynamic findings at sonography before and after creation of a transjugular intrahepatic portosystemic shunt. *AJR Am J Roentgenol* 1993; 160: 627-630
 3. Dodd GD, Zajko AB, Orons PD, Martin MS, Eichner LS, Santaguida LA. Detection of transjugular intrahepatic portosystemic shunt dysfunction: value of duplex Doppler sonography. *AJR Am J Roentgenol* 1995; 164: 1119-1124
 4. Chong WK, Malisch TA, Mazer MJ, Lind CD, Worrell JA, Richards WO. Transjugular intrahepatic portosystemic shunt: US assessment with maximum flow velocity. *Radiology* 1993; 189: 789-793
 5. Foshager MC, Ferral H, Finlay DE, Castaneda-Zuniga WR, Letourneau JG. Color Doppler sonography of transjugular intrahepatic portosystemic shunts (TIPS). *AJR Am J Roentgenol* 1994; 163:105-111
 6. Kanterman RY, Darcy MD, Middleton WD, Sterling KM, Teefey SA, Piltram TK. Doppler sonography findings associated with transjugular intrahepatic portosystemic shunt malfunction. *AJR Am J Roentgenol* 1997; 168: 467-472
 7. Ferral H, Foshager MC, Bjarnason H, et al. Early sonographic evaluation of the transjugular intrahepatic portosystemic shunt (TIPS). *Cardiovasc Intervent Radiol* 1993; 16: 275-279

J Korean Radiol Soc 2000;43:227 - 231

Pulsed Wave and Color Doppler US Findings of Transjugular Intrahepatic Portosystemic Shunts (TIPS)¹

Dong Jin Jung, M.D., Pyo Nyun Kim, M.D., Tae Kyung Kim, M.D.,
Hyun Kwon Ha, M.D., Mun Gyu Lee, M.D.

¹Department of Diagnostic Radiology, University of Ulsan College of Medicine

The transjugular intrahepatic portosystemic shunt (TIPS) is an effective and relatively safe and widely accepted treatment for complications arising from portal hypertension. Shunt or hepatic vein stenosis and shunt occlusion are common short- and medium-term complications arising from the procedure, though if detected early, these conditions may be treated before the recurrence of gastrointestinal bleeding or ascites. Doppler US is a relatively inexpensive, accurate, and noninvasive method for the evaluation of shunt status.

Index words : Liver, interventional procedure
Portal vein, US
Shunts, portosystemic
Ultrasound (US), Doppler studies

Address reprint requests to : Dong Jin Jung, M.D., Department of Diagnostic Radiology, Asan Medical Center, University of Ulsan, College of Medicine, 388-1 Poongnap-dong Songpa-gu, Seoul 138-736, Korea.
Tel. 82-2-2224-4400 Fax. 82-2-476-4719 E-mail: Bookdoo7@chollian.net

1945 10

가

가

1. :

2. :

1) - 100,000

2) - 50,000

3. 1)

2) (12)

3)

4)

5)

4. :

,

5. : 1)

(236page)

2)

6. :