Direct intrahepatic cavo-portal shunts in Budd-Chiari syndrome: role of simultaneous fluoroscopy and trans-abdominal ultrasonography

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Background: Transjugular intrahepatic porto-systemic shunt (TIPS) for Budd-Chiari syndrome (BCS) can be inserted from inferior vena cava or hepatic vein to portal vein. The former is performed when hepatic veins are not suitable and is technically more challenging. Methods: In this retrospective study, 7 patients with chronic BCS needed cavo-portal shunt as hepatic veins were neither amenable to plasty nor provided access for TIPS placement. Simultaneous fluoroscopic and trans-abdominal ultrasound guidance was used at the time of portal vein puncture. Results: Technical success and clinical improvement were obtained in all patients. Median 3 (range 1-4) attempts were needed to puncture the portal vein. There were no significant complications. Uncov-ered stents were used in six patients and stent occlusion was common, but could be managed by re-intervention. Conclusion: Cavo-portal shunt is an effective technique for patients with BCS uncontrolled by medical therapy. Additional trans-abdominal ultrason sound in oblique parasagittal plane keeps the procedure safe. [Indian J Gastroenterol 2006;25:248-250]

Excellent medium-term survival has been reported after the management of Budd-Chiari syndrome (BCS) by interventional radiology.1 Cases with portal hypertension will require porto-systemic shunt, which can be created surgically or by transjugular intrahepatic porto-systemic shunt (TIPS).

A direct intrahepatic cavo-portal shunt is performed in such patients when a hepatic vein (HV) is not available for conventional TIPS or a previous TIPS has failed. The main differences include a longer and tortuous tract, and difference in direction of puncturing from inferior vena cava (IVC). Additional real-time image guidance may be required to confirm the intrahepatic location and direction, and to avoid overshooting the portal vein and extrahepatic passage.

Methods

This is a retrospective analysis of 7 (4 male) patients with BCS who underwent cavo-portal shunt procedure between March 2004 and November 2005 (Table). All patients underwent evaluation for prothrombotic disorders. Five patients had ascites. None had encephalopathy or variceal bleeding; two had jaundice. AST ranged from 40-65 IU/L in five patients; two had levels of 140 and 170 IU/L. Child-Pugh score was 9 in four patients and 10 in three patients. The BCS score2 ranged from 4.22 to 7.31 (mean 6.12); INR was 1.2 to 1.57.

All patients underwent initial ultrasound (US) and Doppler examination. The diagnosis was confirmed by inferior vena cavography, and HV recanalization was attempted at the same sitting. Patients were started on heparin followed by Acitrom. Diuretics were commenced if ascites was present. The indication for shunt was refractory ascites, worsening liver function or advanced chronic liver disease. Cavo-portal shunts were performed as the primary procedure in patients in whom HV angioplasty was not feasible or effective. In two cases it was done following occlusion of previous HV stents.

Procedure

Paracentesis was routinely performed prior to TIPS. The procedures were performed under general anesthesia. Right internal jugular access was used. Any narrowing in the IVC with significant pressure gradient (>10 mmHg) was treated by balloon angioplasty.

TIPS cannula (Transjugular Liver Access Set; Cook, Bloomington, IN, USA) was used, but its curvature was modified whenever required. The image intensifier was kept 45 degrees oblique towards the left side. Trans-abdominal US in oblique sagittal plane provided excellent guidance for estimating the length and course of the shunt. The fluoroscope and US were perpendicular to each other (Fig 1). A point just below the expected HV confluence level was selected to initiate the tract. The cannula and needle were directed towards the right branch of portal vein, close to the portal confluence.

The punctures were performed using a Rosch Uchida needle (Cook). Care was taken not to traverse beyond the portal vein. Additional manipulations were
sometimes required to direct the glide wire towards the main portal vein instead of its right branch. After accessing the portal vein, pressure gradient was measured. Balloon angioplasty was performed prior to placement of the stent. An extra length of the stent was kept in the IVC, so that its end was directed upwards rather than against the opposite wall of the IVC. Check venogram and pressure gradient measurements were performed (Fig 2). Patients were followed up clinically and by US and Doppler on day 1, day 3, 3 months, 6 months and 1 year later.

**Table: Patient details**

<table>
<thead>
<tr>
<th>No.</th>
<th>Age, sex</th>
<th>Presentation</th>
<th>Intrahepatic HV morphology</th>
<th>Intervention</th>
<th>Immediate post-procedure period</th>
<th>Follow up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>22, F</td>
<td>Refractory ascites</td>
<td>Obliterated HV, including previously stented left HV</td>
<td>IVC plasty and cavo-portal shunt</td>
<td>Blocked stent on Doppler on day 3. Thrombolysis and plasty done. Recovery from ascites</td>
<td>16 mo. Plasty once, restenting once. No ascites; albumin improved</td>
</tr>
<tr>
<td>2</td>
<td>29, M</td>
<td>Refractory ascites</td>
<td>Focal IVC stenosis, obliterated HV, including previously angioplastied right HV</td>
<td>IVC plasty and cavo-portal shunt. Stent elongation managed by second stent</td>
<td>No flow on Doppler. Thrombolysed for over 48 h and plasty done. Recovery from ascites</td>
<td>6 mo. No ascites, albumin improved, patent shunt on Doppler</td>
</tr>
<tr>
<td>3</td>
<td>46, F</td>
<td>Refractory ascites</td>
<td>Obliterated HV</td>
<td>Cavo-portal shunt</td>
<td>Recovery from ascites</td>
<td>Nil</td>
</tr>
<tr>
<td>4</td>
<td>7, M</td>
<td>Tender hepatomegaly, mild ascites</td>
<td>Obliterated HV</td>
<td>Cavo-portal shunt</td>
<td>Liver size decreased markedly, ascites cleared</td>
<td>25 mo. Stent plasty thrice, improved albumin</td>
</tr>
<tr>
<td>5</td>
<td>11, M</td>
<td>Refractory ascites</td>
<td>Obliterated HV</td>
<td>Cavo-portal shunt</td>
<td>Recovery from ascites</td>
<td>15 mo. Stent plasty and restenting once. No ascites. Improved albumin</td>
</tr>
<tr>
<td>6</td>
<td>24, F</td>
<td>Refractory ascites</td>
<td>Obliterated HV</td>
<td>Cavo-portal shunt</td>
<td>Recovery from ascites. Transient small intrahepatic collection</td>
<td>6 mo. Minimal ascites, patent shunt on Doppler, improved albumin</td>
</tr>
<tr>
<td>7</td>
<td>35, M</td>
<td>Refractory ascites</td>
<td>Obliterated HV (Gore stent – covered)</td>
<td>Cavo-portal shunt</td>
<td>Recovery from ascites</td>
<td>6 mo. No ascites, normal albumin. Stent stenosis, plasty done</td>
</tr>
</tbody>
</table>

US: ultrasonography, IVC: inferior vena cava; HV: hepatic vein

**Results**

One patient each had polycythemia vera and mild protein C deficiency.

The procedure was technically successful in all patients. The number of intrahepatic passes varied from 1 to 4 (median 3). Significant pressure gradient (>12 mmHg) was confirmed in all patients. For adults 10-mm and for children 8-mm self-expandable stents (Zilver; Cook) were used. The tract was di-
lated with a balloon of diameter 2 mm less than the stent prior to stent placement, and with a balloon equal in diameter to the stent after placement. There was no morbidity or mortality.

All subjects had immediate disappearance of ascites and good diuresis, without diuretics. In two patients with low albumin, there was post-procedure improvement (serum albumin 2 g/dL and 2.6 g/dL to 4.2 g/dL and 3.9 g/dL, respectively). No patient developed hepatic encephalopathy. One developed a transient 3-cm intrahepatic collection.

In the two children who returned with blocked stents, albumin was low at follow up, which prompted a search for shunt dysfunction despite normal Doppler study in one patient. One patient was lost to follow up. All four who came for follow up after 3-6 months had no ascites, but on imaging showed stent occlusion. Successful recanalization and angioplasty was performed in them.

**Discussion**

TIPS potentially offers lower morbidity and mortality than surgical decompression in the treatment of BCS. However, in patients with HV occlusion, and in those with occluded previous TIPS, a shunt can be created between the IVC and portal vein.3,4

Cavo-portal shunt generally requires a longer tract; the average length in our adult patients was 6 cm. The length can be minimized by accessing the IVC below the level of the HV confluence. The direction of the parenchymal tract involves an additional medial angulation in the antero-inferior direction. Entering the portal vein branch too laterally can create difficulty in making a latero-medial turn from the right branch to the main HV. Although the initial reports of cavo-portal shunt were described by fluoroscopic guidance alone, late additional image guidance is stressed to keep the procedure safe. Petersen et al5 have used intravascular ultrasound guidance.

The advantage of trans-abdominal US is its ready availability. Keeping the probe in an oblique parasagittal plane on the right upper abdomen allows simultaneous guidance with fluoroscopy and avoids direct radiation to the person holding the US probe. The indentation of the TIPS cannula on the IVC is readily visible and slippage of the cannula or the needle along the wall of the IVC can be avoided. Most importantly, overshooting of the needle beyond the portal vein, which could be a significant cause for extravasation, can be prevented.

There were no major complications during the procedure. Elongation of the stent was observed in our second patient, while attempting repositioning of the partially delivered stent. It was managed by placing an additional shorter stent.

Case number 4 had congested liver, but no parenchymal damage resulted. Two patients had stent occlusion immediate post-procedure; one of them had underlying prothrombotic state. The longer tracts compared to TIPS could be a factor contributing to the higher rate of stent thrombosis.

We had to use uncovered stents in most of our patients because of financial constraints. Covered stents could have reduced the problem of stent occlusion.6 Shunt occlusion was detected on imaging although the patients did not have ascites. This stresses the need for periodic imaging evaluation. Balloon angioplasty was performed to prevent possible delayed clinical manifestations.

In conclusion, we stress the use of an additional imaging tool while creating direct cavo-portal shunts. This helps in reducing the number of punctures required to create the tract. Although the number of patients in this study is limited, the favorable results indicate that cavo-portal shunts can be performed safely and effectively with additional guidance from trans-abdominal US.

**References**


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