Successful Metallic Stent Placement for Recurrent Stenosis after Balloon Angioplasty of Membranous Obstruction of Inferior Vena Cava

Wei-Chin HUNG,1 MD, Chih-Yuan FANG,1 MD, Chiung-Jen WU,1 MD, Ping-Han LO,2 MD, and Jui-Sung HUNG,2 MD

SUMMARY

A 23 year-old Taiwanese male presented with complete membranous obstruction of the inferior vena cava at its suprahepatic portion. After 3 angioplasty procedures using Inoue-balloon catheters, a Wall stent was deployed for restenosis 4 years after the first procedure. Venography at 6 months showed no significant restenosis. At 20 months transfemoral venography confirmed patency of the vena cava. (Jpn Heart J 2001; 42: 519-523)

Key words: Budd-Chiari syndrome, Balloon angioplasty, Stent

Budd-Chiari syndrome (BCS) represents an outflow obstruction of hepatic venous blood at the hepatic or suprahepatic portion of the inferior vena cava (IVC). Membranous obstruction of the inferior vena cava (MOVC) is the most common cause of the syndrome, and it accounts for one-third of the cases reported in the literature.1-2) This type of membranous obstruction has been described mainly in Asian countries, including Taiwan, China, Japan and India, and also in South Africa.1-6) The etiology of this segmental, membranous obstruction of the IVC remains obscure. It is regarded as congenital by Hirooka and Kimura,5) while Kage, et al contend that the occluded and stenosed lesion in the IVC and hepatic veins result from acquired thrombosis and its sequelae.7) The standard treatment of MOVC has yet to be established. It is generally accepted that it is better to attempt to relieve the major venous obstruction. Balloon angioplasty for MOVC was introduced in the 1970s, and the procedure has become the management of choice. However, restenosis occurs in 3 to 50%, requiring repeat interventions in most of the cases.1,5) The self-expandable metallic stent appears be an attractive adjuvant therapy in restenosis of MOVC after balloon angio-

From the 1 Section of Cardiology, Chang Gung Memorial Hospital, Kaohsiung, and 2 the Section of Cardiology, China Medical College, Taichung, Taiwan.
Address for correspondence: Chih-Yuan Fang, MD, Section of Cardiology, Chang Gung Memorial Hospital, Kaohsiung, 123, Ta-Pei Road, Niao-Sung Hsiang, Kaohsiung Hsien 83305, Taiwan.
Received for publication October 16, 2000.
Revised and accepted February 23, 2001.
plasty. Herein, we report our experience with metallic stenting for managing restenosis of membranous obstruction of IVC.

**CASE REPORT**

A 23-year-old Taiwanese male presented in October 1994 with a two-month history of progressive bilateral leg edema, abdominal fullness, nausea, anorexia and diarrhea. Physical examination revealed mild jaundice, hepatosplenomegaly, superficial vein engorgement in the abdominal wall and ascites. There was venous insufficiency with stasis dermatitis in the lower legs, and edema extending to the thighs. Laboratory tests showed mildly abnormal liver function tests (total bilirubin of 2.7 mg/dl with direct fraction of 1.0 mg/dl, alanine aminotransferase of 47 U/l, aspartate aminotransferase of 43 U/l, and alkaline phosphate of 96 U/l). Hemograms, prothrombin time and activated partial thromboplastin time were normal. Abdominal ultrasonography confirmed hepatosplenomegaly, and showed patent but dilated hepatic and portal veins. Two-dimensional echocardiography showed no abnormality other than trivial mitral and tricuspid regurgitation. Computerized tomography with contrast enhancement showed poor opacification of the distal part of the intrahepatic IVC and dilatation of the azygos and hemiazygos veins. Superior and inferior cava venography obtained simultaneously showed complete membranous obstruction of the suprahepatic portion of the IVC (Figure 1A). After having obtained informed consent, percutaneous transvenous balloon angioplasty (PTBA) was performed. The lesion was punctured successfully with a Brockenbrough needle placed in a Mullins sheath inserted from the right femoral vein. The sheath was then advanced to the right atrium. A 0.025" 260 cm Microvena wire was placed in the right atrium through the sheath. After removing the sheath, the lesion was dilated with a 12 Fr septal dilator used in Inoue-balloon percutaneous transseptal mitral commissurotomy (PTMC). Balloon angioplasty was then performed with a PTMC-24 mm Inoue balloon catheter (Toray Medical Company, Tokyo, Japan) using the stepwise dilation technique with balloon size from 18 to 21 mm at 1 mm increment (Figure 1B). Upon completion of the dilation procedure, the pressure gradient across the obstructive membrane decreased from 22 to 2 mmHg (Figure 1C). There were no complications. Nuclear radiography 3 weeks later confirmed patency of the IVC.

Six months after the procedure the patient began to notice recurrent leg edema, and a second PTBA was performed to correct the restenosis using the same size balloon. Eleven months later the patient underwent a third PTBA which resulted in symptomatic relief for about two and a half years. He was readmitted 4 years after the first procedure because of recurrent leg edema and ascites. Transfemoral venography showed subtotal occlusion of the IVC at the previous balloon angioplasty site (Figure 1D). There was a pressure gradient of 15 mmHg across the lesion. Because of repetitive restenosis following the angioplasty, stent
deployment was recommended. After having obtained informed consent, PTBA was performed. The stenotic lesion was crossed with a 0.025” Terumo wire and a 7 Fr Berman wedge catheter was inserted to the right atrium over the wire. The wire was exchanged with a 0.025” 260 cm Microvena wire. The lesion was predilated with a PTMC-28 mm balloon catheter in a stepwise manner from 26 to 30 mm at 1 mm increments. A Schneider 2.2 x 10 cm metallic Wall stent was deployed, with the distal segment protruding slightly into the right atrium. Postdilation was conducted with a PTMC-30 mm balloon catheter to a balloon diameter of 30 mm. There was a residual stenosis of 26% (minimal luminal diameter of 18.6 mm, and reference vessel diameter of 25.3 mm) (Figure 1E). There no longer was a pressure gradient. The patient resumed warfarin anticoagulation therapy. Repeat venography at 6 months via a right internal jugular vein approach showed a lesion restenosis of 36% (minimal luminal diameter of 16.3 mm, and reference vessel diameter of 25.8 mm) (Figure 1F). The patient was free of symptoms at the latest follow-up visit 20 months after the procedure, and the transfemoral venography showed patency of the IVC.

Figure 1. Vena cava venograms (anterior-posterior view). A: angiogram obtained following simultaneous injection of contrast medium in superior and inferior vena cava demonstrates complete membranous obstruction of suprahepatic portion of inferior cava (black arrow). B: Dilation of the obstructive lesion with an Inoue balloon catheter (first intervention). C: Immediate result after Inoue-balloon angioplasty. D: Restenosis (white arrow) with nearly total occlusion of IVC 4 years after the third balloon angioplasty. E: Venogram immediately following deployment of Wall stent. F: Follow-up venogram at 6 months after stent deployment shows patent inferior vena cava with 36% in-stent stenosis (white arrowhead).
DISCUSSION

History and physical examination, as exemplified in our patient can readily make diagnosis of IVC obstruction. However, non-invasive and invasive imaging studies are required to delineate the exact site, type, and etiology of the obstruction. Among these, angiography has remained the classic imaging method. In our case, superior and inferior cava venography obtained simultaneously confirmed the diagnosis of MOVC. Because medical treatment in MOVC carries a poor prognosis, it is generally agreed that an invasive procedure is required to relieve the venous obstruction. The first successful surgical treatment of MOVC using transcardiac finger membranotomy was reported by Hirooka and Kimura in 1962. However, this surgical procedure has a high rate of IVC thrombosis, and long-term IVC patency is less than 50%. Meso-atrial shunts were developed by Stringer, et al in 1989 for portal decompression. The success rate for this surgical procedure varies from 38% to 86%. Because of shunt thrombosis, the follow-up patency rate ranged from 33 to 60%. In view of the unfavorable surgical results, Eguchi, et al in 1974 applied balloon angioplasty for the treatment of MOVC. In contrast to a success rate of less than 50% obtained earlier, recent skill and technique improvements have achieved a high PTBA success rate of 90%, and a 1-year patency rate of 80 to 100%. Although Yang, et al reported an encouraging long-term (8 years) post-PTBA patency rate of 97%, restenosis following PTBA remained as a major problem, with an incidence of 50%, and requiring repeated PTBA. Therefore, self-expandable metallic stents have been used since the mid-1980s to prevent restenosis after PTBA. The post-stenting restenosis rate of 0 to 12% during long-term follow up is lower than PTBA. In some cases, when the lesion is not amenable to angioplasty, primary stent placement also achieves high success and long-term patency rates. Our patient underwent two repeat PTBAs because of restenosis, and the fourth procedure with deployment of a metallic stent enabled him to remain free of symptoms at the latest follow-up 20 months after the procedure. Patency of the IVC was confirmed by transfemoral venography. What is the critical time span for restenosis after balloon angioplasty? According to Xu, et al follow ed. up patients for 38 to 68 months (mean 52.2 months), the restenosis rates for the first, second and third years were. 20%, 25% and 5%, respectively. No one was over 3 years. Upendra, et al reported a restenosis interval ranging from 4 months to 4 years. The result is unlike coronary angioplasty restenosis occurring within 6 months. From reported data and our experience in this case, deployment of a metallic stent appears to be the treatment of choice in patients with MOVC.

In patients with MOVC, thrombus formation is not an uncommon complication, being reported in 28.6% of cases by Yang, et al. Deaths have been reported to occur in patients after PTBA or stenting due to massive pulmonary
embolism.\textsuperscript{1,18} Therefore, continuation of anticoagulation is recommended following the intervention procedure. However, opinion is divided as to the length of long-term anticoagulation treatment. It may be prudent to continue the anticoagulation treatment indefinitely after the procedure.

REFERENCES