Case report

Stent implantation for post-Mustard systemic venous obstruction

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Abstract

In this paper, we report on the use of stents in the treatment of late-onset post-Mustard systemic venous obstruction in three patients with clinical signs of obstructive caval syndrome. After unsuccessful balloon dilation, Palmaz-Schatz stents were implanted at the veno-atrial junction. Further dilation has been achieved using high-pressure balloons. Vessel diameter increased from 4.4 ± 1.8 to 13 ± 1.7 mm (P < 0.05) and the trans-stenotic pressure gradient dropped from 8 ± 6 to 0 mmHg (P < 0.01), with clinical improvement. After 26 ± 4 months of non-invasive follow-up, no signs of recurrent stenosis were observed. Stent implantation is effective in the treatment of systemic venous obstruction after Mustard operation. © 1998 Elsevier Science B.V. All rights reserved

Keywords: Transposition of the great arteries; Atrial switch operation; Systemic venous obstruction; Stent implantation

1. Introduction

Physiological correction of transposition of the great arteries (TGA), the main surgical approach up to the late 1970s [1], may be complicated in 5–10% of cases by systemic venous pathway obstruction, which may be due to improper baffle geometry and suture line placement, contraction of the pericardial or synthetic baffle material, scar tissue or adhesions involving the baffle and the excised margins of the atrial septum [1–6]. Regardless of the underlying mechanism, this complication is difficult to manage and further surgery is frequently indicated [1,5,6]. However, surgical relief of the venous obstruction may be incomplete and does not eliminate the potential for stenosis recurrence. Since the early 1980s, transluminal balloon angioplasty became an important alternative to surgery in the treatment of caval obstructions secondary to atrial switch procedure [7–9], but the scanty results of this procedure and the high rate of recurrence of the obstruction prompted the testing of other therapeutic options. Over time, stent implantation has proved to be highly effective in the long-lasting relief of native or post-surgical systemic venous obstructions although, to date, only few reports of the use of stents in post-Mustard systemic venous obstructions have been published [10]. In this paper, we report on three cases of post-Mustard systemic venous obstruction successfully relieved by stent implantation and describe a technical modification of the transcatheter stent deployment.

2. Case report

During a long-term follow-up after the Mustard procedure for transposition of the great arteries, three patients (mean age 7.6 ± 2.0 years, mean weight 25 ± 8 kg), were referred to our institution for headache, dyspnoea and easy fatigability as well as clinical signs of systemic venous obstruction (i.e. jugular enlargement in two cases and hepatomegaly in one case). One patient had already had previous surgery for superior vena cava stenosis, and pace-makers had been implanted in two patients. Electrocardiogram showed normal sinus rhythm and right ventricular overload signs. Chest X-ray showed mild car-
diac enlargement with right ventricular hypertrophy and normal pulmonary vascular markings. At echocardiography, the morphological and color-Doppler signs of a moderate/severe stenosis at the vena cava/atrial junction (superior vena cava/atrium junction in two cases, inferior vena cava/atrium in one case) were found, prompting us to perform cardiac catheterization in order to relieve the stenosis and avoid reoperation. At catheterization, right- and left-sided hemodynamic variables were recorded and angiograms were performed at the superior and inferior vena cava level (Fig. 1A) to carefully outline the stenotic segment (Table 1). In all cases, balloon angioplasty was performed without any significant angiographic and hemodynamic improvement. Thus, implantation of Palmaz–Schatz stents was performed. From the femoral vein access, an exchange guide-wire was passed distal to the stenosis and captured with a snare guide-wire inserted from the internal jugular vein, so performing a veno-venous loop. Over this guide-wire, an 11F long sheath was passed beyond the stenotic site and the stent was implanted by inflating the supporting balloon catheter (Mansfield 7F, 12–30 mm). Further dilations with a high pressure balloon (Meditech Blue Max, 12 mm, 15 atm) were performed to fix the stent at the site of the stenosis and eliminate any residual waist. After the stent implantation, the stenosis diameter increased from $4.4 \pm 1.8$ to $13 \pm 1.7$ mm ($P < 0.05$) and the trans-stenotic pressure gradient dropped from $8 \pm 6$ to $0$ mmHg ($P < 0.01$). After the procedure, the angiograms were repeated (Fig. 1b) and the patients were given antiplatelet and anticoagulation therapy for 6 months. After stent implantation, clinical and instrumental follow-up controls were planned every 6 months. Neither recurrence of symptoms nor signs of systemic venous stenosis were recorded during a follow-up period of $26 \pm 4$ months.

3. Comment

For a long time, atrial switch operation has been considered as the treatment of choice for transposition of the great arteries, due to acceptable mortality and morbidity [1]. Systemic venous obstruction is a well known complication of the atrial switch operation since it has been used, occurring in 5–10% of the cases and requiring reoperation if symptomatic [1,2]. However, surgical treatment of the venous obstruction carries substantial risks, may not completely abolish the obstruction and does not eliminate the potential for its recurrence [1,6]. Thus, percutaneous balloon angioplasty has been attempted, in order to avoid reoperation, but the efficacy of this procedure has often been scanty and short-lasting [7–9]. To manage the systemic venous lesions that experience suboptimal relief from balloon angioplasty, endovascular stents have been used to provide a rigid framework for vessel support, thus avoiding the elastic recoil of the stenotic segment after balloon dilation. However, the stent implantation at the systemic venous–atrial junction level to relieve the venous obstructions secondary to atrial switch operation has been rarely reported [10]. In this setting, life-threatening complications of the stenting procedure are the migration or embolization of the stent and the mitral valve disfunction. These problems can be avoided by using an extra-stiff guide-wire or passing an exchange guide-wire from the femoral vein to the right internal jugular vein, finally coming out from a pre-positioned venous introducer, the so-called veno–venous loop. This approach allows the long sheath to straighten the

<table>
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<tr>
<th>Patient number</th>
<th>Stenosis</th>
<th>Diameter (mm)</th>
<th>Final diameter (mm)</th>
<th>Stent length (mm)</th>
</tr>
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<tr>
<td>1</td>
<td>IVC</td>
<td>3.5</td>
<td>12</td>
<td>18</td>
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<tr>
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<td>SVC</td>
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<td>SVC</td>
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<td>30</td>
</tr>
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</table>

Fig. 1. Inferior vena cava angiography in postero-anterior view showing a severe obstruction at the IVC/RA junction (A), successfully relieved by stent implantation (B).
venous pathway, so that the stent can be more easily and safely positioned across the stenosis, without leaning on the mitral valve during its deployment. The tip of the extra-stiff guide-wire is pulled outside the internal jugular vein introducer, firmly secured by one of the operators. Tension is then applied at the femoral end of the guide-wire, which acts as a rail, enabling an easy and safe passage of the long-sheet through even the tightest stenosis, without the risk of vessel distortion or damage, or sheet kinking. Additionally, the vertical and straight course of the guide-wire minimizes the possibility of mitral valve injury. In our experience, stent implantation successfully abolished the stenosis and completely relieved the symptoms and signs of systemic venous congestion over a short-term follow-up period.

In conclusion, stent implantation could be considered safer and more effective than other therapeutic options for relieving the post-Mustard systemic venous obstructions.

References


