Intracardiac endograft stent of inferior vena cava stenosis after cardiac surgery

Tiago Soares, MD,[a,b] Paulo Dias, MD,[a,b] Sérgio Sampaio, PhD,[b] *and* José Teixeira, MD,[a] *Porto, Portugal*

ABSTRACT

Iatrogenic injury of the inferior vena cava is very uncommon but can lead to serious devastating sequelae. This can occur during reoperative or congenital surgery but also during routine cardiac surgery. We have presented a very rare case of a partial obstruction of the inferior vena cava–right atrium junction after multiple cardiac surgeries, which was treated using an endovascular percutaneous approach. (J Vasc Surg Cases Innov Tech 2022;8:67-9.)

Keywords: Inferior vena cava; Intracardiac stent; Cardiac surgery

Most cases of inferior vena cava (IVC) injury are related to trauma, with dramatic and potentially life-threatening presentations.[1] Complications involving the IVC after cardiac surgery are very uncommon, with a few case reports describing IVC–right atrium junction stenosis after cardiac surgery.

We have reported the case of a patient with significant hemodynamic stenosis of the IVC at its junction with the right atrium after multiple cardiac surgeries. The patient presented with ascites and was successfully treated with an intracardiac endoprosthesis stent. The patient provided written informed consent for the operation and the report of her case details and imaging studies.

CASE REPORT

A 56-year-old woman had been referred to the vascular department with a partial obstruction of the IVC–right atrium junction associated with signs of hepatic congestion and ascites (Fig 1). The patient had a history of aortic and mitral valve endocarditis that had been treated with biologic valve replacement. A dual-chamber artificial pacemaker implantation was required postoperatively because of third-degree atrioventricular block. At 3 years after the first surgery, she had developed a mitral paravalvular leak and moderate tricuspid regurgitation, which were associated with symptoms of superior vena cava syndrome (face and neck swelling). She again underwent surgery with substitution of the mitral biologic valve with a mechanic valve, tricuspid annuloplasty, and plasty of the right atrium and superior vena cava with a bovine pericardial patch.

The patient was referred to the vascular department by cardiac surgeons, 4 months after her last surgery. The blood test results revealed liver dysfunction with signs of central venous hypertension. In the previous few months, she had required paracentesis to relieve the abdominal pain and dyspnea caused by massive ascites. From the previous study, abdominal ultrasound showed ascites with portal and portal–hepatic patent venous flow, and a transthoracic echocardiogram demonstrated a partial obstruction of the IVC–right atrium junction with 15 mm Hg peak flow and 10 mm Hg mean flow gradient. Computed tomography angiography (CTA) confirmed significant stenosis of the IVC junction (8 × 9 mm diameter) and proximal IVC mild ectasia (20 × 22 mm diameter).

The mechanism causing this complication could not be established. We could only presume that closure of the right atrium was very close to the tourniquet or clamp that had been controlling the IVC around the caval cannula and that this had caused suture placement under compromised conditions during the previous IVC/right atrium patch angioplasty, leading to the stenosis.

The patient was sedated, and the operative site was prepared in the usual sterile fashion. After ultrasound-guided access with puncture of the right common femoral vein, a 12F sheath was passed. Phlebography was performed to confirm the CTA findings (Fig 2, *A*), and intravascular ultrasound (IVUS) was used to measure the proximal IVC (mean diameter, 21 mm) and mark the IVC–right atrium junction stenosis (minimum residual diameter, 8 mm). Finally, we predilated the stenosis with a 24 × 40 mm Atlas PTA balloon (Bard; BD, Franklin Lakes, NJ; Fig 2, *B and C*) and deployed an intracardiac self-expandable Wallstent endoprosthesis (Boston Scientific, Marlborough, Mass) with a 24 mm diameter and 75 mm extension (Fig 2, *D*). The final angiogram revealed a good stent position and no evidence of residual stenosis, confirmed by IVUS. The patient recovered well and was discharged the next day. Postoperative transthoracic echocardiogram revealed a patent IVC stent with a 3 mm Hg mean flow gradient of the IVC–right atrium junction. During the first year of follow-up, she had experienced significant clinical improvement without the need for more

From the Department of Angiology and Vascular Surgery, São João Hospital Centre[a]; and the Department of Surgery and Physiology, Faculty of Medicine, University of Porto.[b]

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Correspondence: Tiago Soares, MD, Department of Angiology and Vascular Surgery, São João Hospital Center, Alameda Professor Hernâni Monteiro, Porto 4200-319, Portugal (e-mail: tiagojoaosoares@hotmail.com).

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Fig 1. Signs of hepatic congestion with massive ascites.

Fig 3. Sagittal view of follow-up computed tomography angiogram (CTA) after 1 year showing stent patency and no evidence of restenosis.

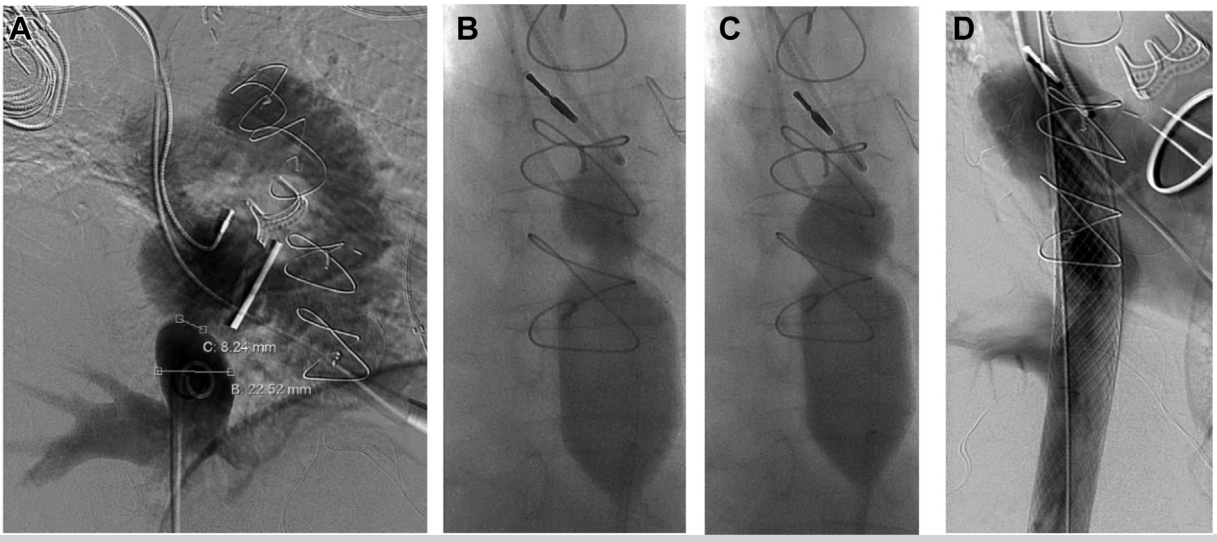

Fig 2. A, Angiogram showing severe stenosis of the inferior vena cava (IVC)–right atrium junction. **B,C,** Predilatation with a 24- × 40-mm Atlas PTA balloon (Bard; BD). **D,** Angiogram showing a 24- × 75-mm intracardiac self-expandable Wallstent endoprosthesis (Boston Scientific), without residual stenosis.

paracentesis and continued with warfarin therapy. The 1-year follow-up CTA confirmed stent patency with no evidence of restenosis (Fig 3).

DISCUSSION

IVC stenosis is uncommon, with infrequent studies reported. It is potentially highly morbid and can lead to extensive thrombosis of the venous system.[2] Only a few cases of IVC–right atrium junction stenosis have been described after cardiac surgery, usually as a complication of cardiac transplantation, and were treated surgically.[3,4] The present case was special, not only because of the rarity of the complication after routine cardiac surgery, but also because of the innovative treatment solution using the endovascular approach.

The management of IVC stenosis depends on the clinical scenario, the severity of the stenosis, and the time elapsed after surgery. Although IVC stenosis can be difficult to detect, the clinical signs will point to the diagnosis because most of the venous return will be through the

IVC. A timely diagnosis and repair are essential to prevent congestive end-organ damage and hemodynamic instability from impaired preload. Normally, this complication will have early symptoms, and open surgical repair will likely be the best approach. In the present case, 4 months had passed, and surgical reoperation would have been technically challenging, with high morbidity and mortality.

Thus, we believed the endovascular approach would be the most appropriate solution because it decreased the risks associated with repeat open surgery and allowed for an immediate decrease in the pressure gradient, with easier passage through the IVC to the right heart cavities.

Previous venous studies have shown that lesions treated with isolated balloon dilation had a high restenosis rate.[5] Thus, the addition of stenting is likely to be better for maintaining long-term patency. The additional use of IVUS in such cases can be useful to provide a more accurate measure of the lumen diameter to prevent stent migration and also to mark the exact point of stenosis for the correct stent position. We opted for a Wallstent endoprosthesis stent (Boston Scientific) because of the large diameter availability, closed cell design for straight vein anatomy, and institution experience. The excellent follow-up results for our patient have demonstrated the feasibility and safety of this procedure.

CONCLUSIONS

The results from the present patient have emphasized the importance of a prompt diagnosis of IVC—right atrium junction stenosis after cardiac surgery and highlighted the treatment option chosen. An endovascular approach for these cases is an attractive and safe alternative to open surgery, with reduced risks. The reported data for this approach have been limited to case studies, and further evaluation of long-term results is warranted.

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