

Hybrid treatment of an aortic pseudoaneurysm arising at the innominate artery junction secondary to superior vena cava stenting

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Pseudoaneurysm of the innominate artery secondary to superior vena cava stenting has never been reported. We report the case of a 42-year-old woman previously treated for a Masaoka stage III thymoma with superior vena cava replacement through median sternotomy followed by adjuvant radiation therapy. Four years later, the patient came back with a large pseudoaneurysm at the junction of the innominate artery and ascending aorta. To avoid re-sternotomy, endovascular deployment of a stent graft in the ascending aorta with a periscope stenting in the left common carotid artery after axilloaxillary bypass was performed to treat this aortic pseudoaneurysm. (*J Vasc Surg Cases* 2015;1:127-9.)

Aortic pseudoaneurysm arising at the innominate artery junction is a rare occurrence. The usual causes include traumatic and iatrogenic causes, but superior vena cava (SVC) stenting has not been previously reported. We report a case of closure of a pseudoaneurysm of the junction of the innominate artery and the aorta secondary to SVC stenting with hybrid treatment.

CLINICAL PRESENTATION

A 42-year-old woman was admitted with an innominate artery pseudoaneurysm resulting from SVC stenting. She was previously operated on for a Masaoka stage III thymoma through median sternotomy by wedge resection of the right upper and middle lobe, thymomectomy, and bypass grafting (polytetrafluoroethylene vascular graft) between the left innominate vein and right atrium followed by adjuvant radiation therapy (60 Gy). One year later, she presented with acute SVC syndrome resulting from thrombosis of the bypass graft because she stopped her anticoagulation treatment. She underwent a retrograde recanalization with a nitinol self-expandable uncovered stent (Luminexx; Bard, Salt Lake City, Utah) and two nitinol self-expandable covered stents (Fluency, Bard). Ten months later, she presented with a recurrent intrastent thrombosis with SVC syndrome treated with anticoagulation therapy. Four years after

the initial operation, the patient was seen for hemoptysis. The findings on fibroscopy were normal. The computed tomography scan showed a 25 × 35-mm pseudoaneurysm at the junction of the innominate artery and aortic arch resulting from a large ulceration secondary to bypass graft stenting (Figs 1 and 2). The patient's consent to publish data has been obtained.

PROCEDURE

In the hybrid operating room, under general anesthesia, a left to right axilloaxillary bypass was performed using a prosthetic polytetrafluoroethylene 7-mm graft (Distaflo, Bard) by two end-to-side anastomoses. Bypass tunnelization was performed underneath the skin under videoscopic control to prevent any venous bleeding.

Through the right brachial artery, angiography was performed using a 5F pigtail catheter (Cook Inc, Bloomington, Ind) advanced into the ascending aorta.

Through right femoral access, a 260-cm, 0.035-inch guidewire (Terumo Medical Corporation, Tokyo, Japan) was placed under fluoroscopic control into the ascending aorta and replaced by a stiff guidewire (Starter; Boston Scientific, Galway, Ireland), and the aortic stent graft (Valiant; Medtronic Vascular, Santa Rosa, Calif) was delivered in the ascending aorta. The proximal and distal landing zones were, respectively, 54 mm and 22 mm. A homemade endograft (diameter, 32 mm; length, 150 mm) shortened to 65 mm was used.

Through left femoral access, a 260-cm, 0.035-inch guidewire (Terumo Medical Corporation) was placed under fluoroscopic control into the left common carotid; a 4F catheter (Glidecath, Terumo) was advanced into the left common carotid over the guidewire. This catheter was used to exchange the guidewire for a stiff guidewire (Starter). A 10- × 80-mm self-expandable covered stent (Fluency) was used for the left carotid retrograde revascularization.

The stent graft (Valiant) and the self-expandable covered stent (Fluency) were deployed simultaneously under fluoroscopic control using an antegrade periscope

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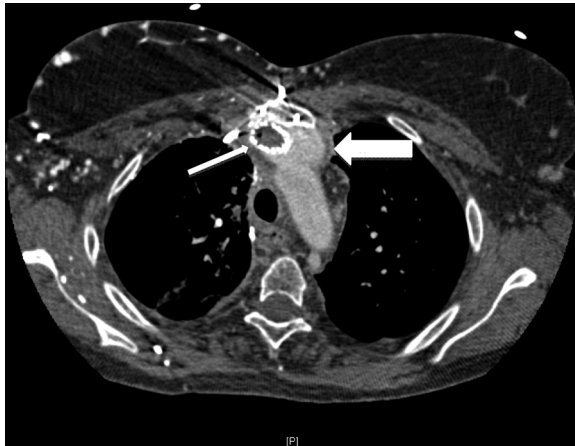


Fig 1. Preoperative computed tomography scan. *Thin arrow*, Superior vena cava (SVC) stent. *Thick arrow*, Pseudoaneurysm arising from the junction of the innominate artery and aorta.



Fig 2. Preoperative angiogram. *Arrow*, Pseudoaneurysm arising from the junction of the innominate artery and aorta.

technique. The stent graft was positioned between the origin of the coronary arteries and the origin of the left subclavian artery. Ballooning was performed in the carotid stent using a 9-mm balloon (Fox Plus; Abbott, Santa Clara, Calif).

Occlusion of the innominate artery was performed through the right subclavian artery with a coil embolization (Interlock, 14 mm × 30 cm; Boston Scientific) and deployment of a 16 × 8-mm plug (Amplatzer; AGA Medical Corporation, Plymouth, Minn) in the origin of the innominate artery. A baseline angiogram was obtained to confirm proper position of the stent graft, patency of the common carotid covered stent and axilloaxillary bypass, and



Fig 3. Postoperative baseline angiogram showing patency of axilloaxillary bypass and left common carotid covered stent and exclusion of pseudoaneurysm.

complete exclusion of the lesion (Fig 3). The patency of the vascular reconstruction was confirmed by computed tomography scan at 18 months.

DISCUSSION

SVC syndrome is an obstruction of flow through the SVC caused by a variety of malignant or benign entities.¹ Treatment by percutaneous delivery of metallic stents was initially reported in 1986 and since then has been used extensively.² Successful stent deployment generally results in restoration of laminar blood flow with early resolution of symptoms and long-term patency of the SVC.^{3,4} Gwon et al⁵ showed that endovascular polytetrafluoroethylene-covered stents seemed to be superior to uncovered stents in terms of stent patency. However, the covered and uncovered stents did not differ significantly in terms of patient survival and clinical success. Complications are uncommon, and few have been reported. These include migration or misplacement of the stent, thrombotic stent occlusion, puncture of the right atrium, pericardial tamponade, pulmonary edema, rupture of the SVC, and laceration of the aorta.⁶⁻⁹ We believe that this case is the first documented case of innominate artery pseudoaneurysm secondary to SVC stenting.

Pseudoaneurysms generally develop when there is a disruption in the continuity of the arterial wall resulting from traumatic or iatrogenic causes, biopsy and catheterization being the most frequent of the latter.¹⁰ Despite their scarcity, pseudoaneurysms of the supra-aortic arteries carry a significant risk of disabling neurologic symptoms or death.¹¹ Our patient presented with a pseudoaneurysm arising from the junction of the innominate artery and the aorta.

The conventional treatment is surgical repair requiring a median sternotomy with or without cardiopulmonary bypass and induced hypothermia. Even in the hands of an experienced surgeon, there is considerable morbidity and mortality related to open repeated surgical repair.¹² The emergence of endovascular treatments therefore presents an alternative to the conventional surgical treatment of pseudoaneurysms arising from the origin of the innominate artery and the aorta. Percutaneous closure of aortic pseudoaneurysm by an occluder device has already been described. Technical considerations include the pseudoaneurysm neck measurement, which influences the choice of device, and the presence of infection, which should preclude the use of an implanted device. Complications include pseudoaneurysm rupture, device migration, and recurrence.¹³ The history of previous surgery through median sternotomy with adjuvant mediastinal radiation therapy led us to avoid resternotomy and to choose a hybrid approach. To provide an appropriate landing zone for the aortic stent graft and to preserve perfusion to the supra-aortic trunks, we performed an axilloaxillary bypass and a left common carotid artery stenting described as the periscope technique.

The periscope technique is used to extend the distal landing zone during endovascular treatment. This technique has proved to be a feasible, safe, and effective way to treat thoracoabdominal aneurysms.¹⁴ Nevertheless, perioperative complications, such as dislocated stent graft, significant pressure gradient in the branch device requiring additional balloon inflation or stenting, and type I endoleak, have been described.¹⁵ Furthermore, there are some limitations to this technique: patency of iliac arteries, diameter of aorta ≥ 16 mm (periscope graft is perfused in a retrograde manner and depends on distal aortic perfusion), diameter of target artery ≥ 4 mm with a landing zone ≥ 1 cm, and high-end imaging tools are required.¹⁵

CONCLUSIONS

This case report demonstrates that hybrid treatment can be safely and effectively used to treat pseudoaneurysms at the junction of the innominate artery and aortic arch in a minimally invasive manner. Long-term follow-up will be necessary to ensure that the favorable early outcome that we obtained is durable.

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