A novel technique for the treatment of a ruptured para-anastomotic thoracic aortic aneurysm in the presence of a chronic abdominal aortic dissection

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ABSTRACT

We report the case of a 69-year-old woman with Marfan syndrome and a history of multiple thoracic aortic surgeries and a coexisting dissection of her abdominal aorta. She had presented with a ruptured para-anastomotic thoracic aortic aneurysm due to an infected graft. She was treated with two parallel Nellix endografts that were placed in the true and false lumens. The surrounding endobags were inflated with a polymer that completely sealed the ruptured aorta and preserved blood flow to the visceral arteries. Postoperative imaging showed complete exclusion of the aneurysm with patency of all aortic branches and no evidence of endoleak. (J Vasc Surg Cases and Innovative Techniques 2021;7:350-3.)

Keywords: Aortic dissection; Marfan syndrome; Para-anastomotic aneurysm; Parallel stent grafts; Thoracic endovascular aneurysm repair

Marfan syndrome is a systemic disorder of connective tissue caused by mutations in the fibrillin-1 gene. Aortic aneurysms and dissections are the most life-threatening manifestations of Marfan syndrome.[1-3] Marfan syndrome accounts for 50% of cases of acute aortic dissection in patients aged <40 years.[4] Traditionally, aneurysms and dissections in this group of patients have been treated with open surgery with acceptable outcomes.[5-9] The tendency has been to avoid endovascular treatment in patients with Marfan syndrome and to perform endovascular repair only for cases of late, localized pseudoaneurysms. The repair will typically consist of stenting across the native tissue aneurysm from "graft to graft."[10-12]

We present the case of a patient with Marfan syndrome who had been admitted to our hospital with a ruptured para-anastomotic aortic aneurysm. The rupture had occurred at the site of the anastomosis between an infected Dacron graft and a dissected segment of the thoracic aorta. Because the patient had previously undergone several aortic surgeries, we elected to perform an endovascular repair. The abdominal aorta had a long, residual dissection flap extending from the celiac artery to the iliac arteries, and the rupture had occurred cephalad to the visceral segment. These anatomic features precluded treatment with an aortic cuff or a bifurcated device. We elected to repair the rupture with two Nellix endoprosthesis (Endologix, Irvine, Calif), which would allow for extension of the previous Dacron graft into the abdominal aorta and guarantee sealing of the rupture with the use of the attached endobags and still provide flow to the visceral arteries. The patient provided written informed consent for the report of her case details and images.

CASE REPORT

A 69-year-old woman with Marfan syndrome was referred to our hospital with severe chest pain that had started several hours before admission. Her surgical history consisted of aortic valve replacement and replacement of the aortic arch and descending thoracic aorta with a frozen elephant trunk 1 year previously.

Five months before the present admission, she had undergone replacement of her distal thoracic aorta with a Dacron graft owing to enlargement of the distal thoracic aorta. She was known to have a residual asymptomatic dissection of the abdominal aorta that extended from the level of the diaphragm to the iliac arteries.

On admission, the patient was afebrile and hemodynamically unstable, with a blood pressure of 80/60 mm Hg and a pulse of 114 bpm. Blood analysis showed a leukocyte count of 27,000/μL, hemoglobin of 8 g/dL, and C-reactive protein of 200 mg/L. A computed tomography angiogram (CTA) demonstrated extravasation of contrast from the distal Dacron graft anastomosis (Fig 1), gas and fluid surrounding the Dacron graft, and a new left sided pleural effusion, all evidence of an infected graft and a ruptured para-anastomotic aortic aneurysm. The CTA also showed patent true and false lumens of the aortic dissection in the abdominal aorta, a finding evident on previous imaging studies.

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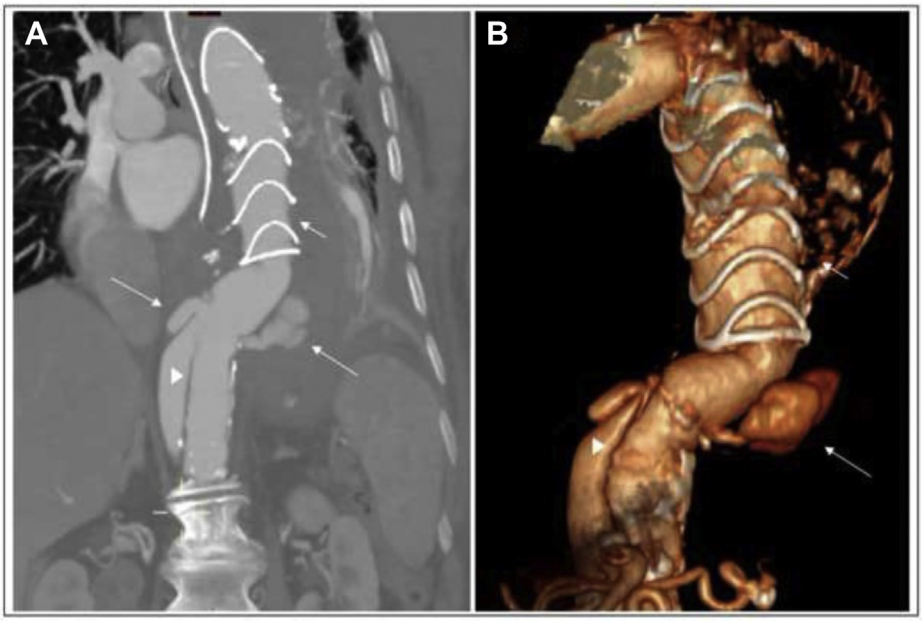

Fig 1. Rupture of para-anastomotic aneurysm. Computed tomography angiogram (CTA), coronal view **(A)** and three-dimensional reconstruction **(B)**, demonstrating the frozen elephant trunk (*short arrow*), Dacron graft and contrast extravasation surrounding the distal anastomosis of the graft (*long arrow*), and the remaining aortic dissection (*arrowhead*).

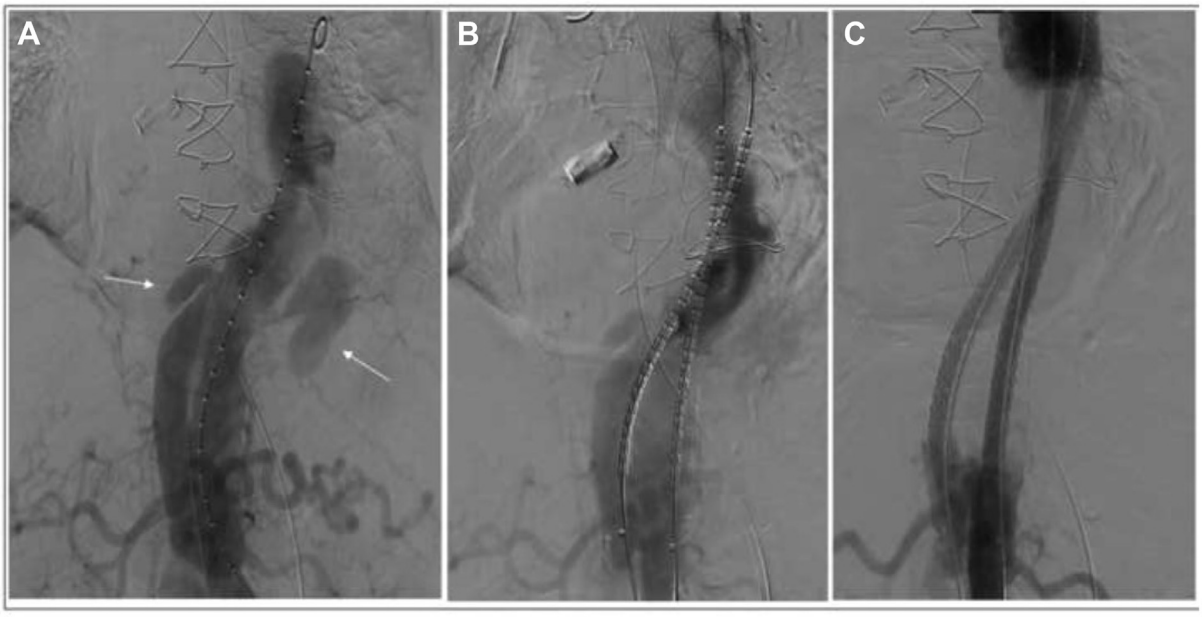

Fig 2. Endovascular sealing of the disrupted anastomoses. **A,** Demonstration of bleeding through the distal anastomosis between the Dacron graft and dissected thoracoabdominal aorta (*arrow*). **B,** Two sets of the Nellix sealing device were placed inside each lumen of the dissecting aorta. **C,** Completion angiogram after unsheathing and deployment of the stents and injection of polymer into the endobags showing perfusion of both lumens and no extravasation.

The patient was not a candidate for open repair owing to the multiple previous aortic operations. An endovascular repair was considered however this was challenging due to the existing abdominal aortic dissection with visceral arteries originating from both lumens. The patient underwent an urgent operation, with a plan to seal the ruptured aorta using Nellix endografts with the attached endobags, maintaining the blood flow to both lumens.

The procedure was performed in a dedicated hybrid operating room with the patient under general anesthesia. After exposure

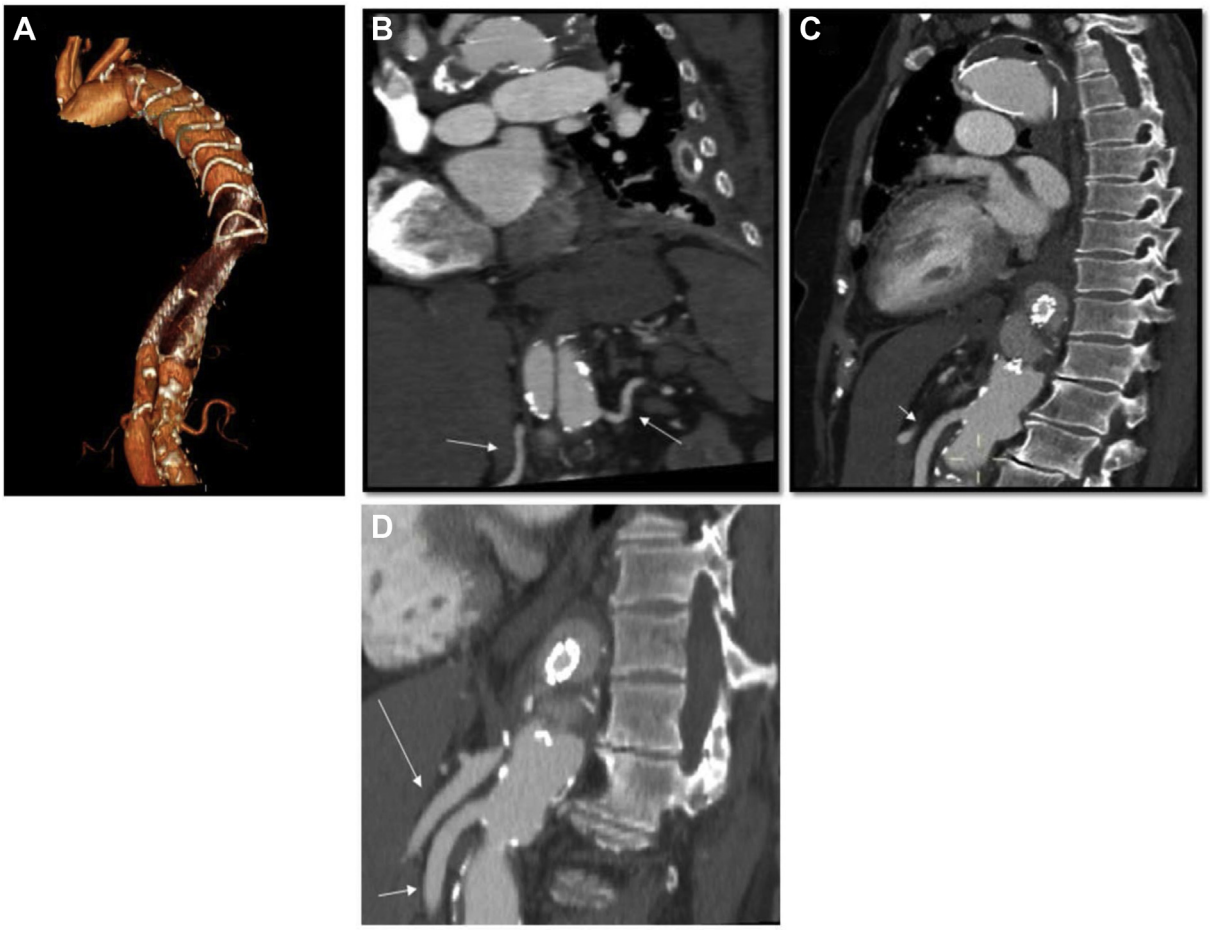

Fig 3. A, Three-dimensional reconstruction of computed tomography angiogram (CTA) during follow-up. Two sets of the Nellix stents inside the frozen elephant trunk to each lumen of the dissecting aorta. **B,** CTA showing the right and left renal arteries well perfused (*long arrows*). **C,** CTA demonstrating superior mesenteric artery (*short arrow*). **D,** CTA demonstrating celiac artery (*long arrow*) and superior mesenteric artery (*short arrow*).

of both femoral arteries, a 6F sheath was inserted bilaterally. Two pigtail catheters were introduced through the femoral arteries, and angiography was used to confirm that one catheter was positioned in the true lumen and the other in the false lumen. A diagnostic angiogram demonstrated extravasation of contrast from the anastomosis between the Dacron graft and the residual native descending thoracic aorta (Fig 2, *A*). We inserted two parallel Nellix endografts, each 10 mm in diameter and 140 mm in length. The endografts were positioned proximally within the descending aorta and distally within the abdominal aorta, landing proximal to the celiac artery. Using the Endosize software (Therenva, Rennes, France), we estimated the volume of polymer required to obtain a seal at ~100 mL. After deployment of the endografts, we inflated the endobags with the required volume to a pressure of 180 mm Hg, creating the seal (Fig 2, *B*).

A completion angiogram demonstrated patent stent grafts and adequate perfusion of the visceral arteries, with no extravasation of contrast material (Fig 2, *C*). The patient then underwent left thoracotomy with opening and drainage of the pleural space and aneurysmal sac surrounding the graft, with placement of drains within both spaces, followed by daily irrigation of the chest with a gentamycin solution.

Cultures from the pleural fluid grew *Pseudomonas aeruginosa* and *Candida albicans,* and blood cultures grew *P. aeruginosa*. She was treated initially with intravenous meropenem and cefazolin, which was later changed to ciprofloxacin and fluconazole in accordance with the sensitivities. The total duration of the antibiotic treatment was 2 months.

A follow-up CTA demonstrated a good position of both endografts and their endobags, with substantial improvement of the inflammatory reaction surrounding the aorta and patent visceral arteries (Fig 3).

The patient was discharged home after 8 weeks in good condition. She was asymptomatic, her vital signs were normal, and the blood analysis results were unremarkable. Our recommendation was to continue the antibiotic treatment and follow-up at our clinic. She was unwilling to continue the treatment and was lost to follow-up.

DISCUSSION

The safety and efficacy of endovascular aneurysm repair (EVAR) for ruptured thoracic and abdominal aortic aneurysms have been evidenced in many studies.[13,14] The device configurations typically used in these cases have consisted of bifurcated, tube grafts, or aorto-uni-iliac endografts.[14] These devices, however, might not be applicable in patients with unfavorable anatomy such as large diameter sealing zones, tortuous access vessels, or the presence of dissection. In the present patient, EVAR with standard devices was not possible because of the presence of a coexisting aortic dissection. One solution we considered was to place two parallel covered stents across the ruptured area, such that each limb extended into a separate lumen in a "side-by-side" fashion. This technique was previously described in a case report by Wang and Malas.[9] They reported a patient who had undergone elective repair of an expanding descending thoracic aneurysm.[9] In their patient, the two dissection channels were treated with placement of multiple stent grafts. The use of Nellix stents was considered in their discussion as a theoretical option. We elected not to use standard limbs as we were concerned that this type of repair would result in a residual gutter endoleak between the components which would be disadvantageous in the setting of an aortic rupture.

The Nellix endovascular aneurysm sealing system used in the present case consists of stent-grafts surrounded by endobags filled with a biocompatible polymer. This device was designed to treat abdominal aortic aneurysms by sealing the aneurysm sac. Its use in cases of ruptured aortic aneurysms and dissecting aneurysms has rarely been reported.

We have presented a novel technique of side-by-side stenting of both lumens with Nellix limbs, achieving sealing of the ruptured aorta. Although the anatomic scenario present in our patient is uncommon, this technique can be applied in certain cases in which a chronic dissection coexists and both the true and false lumens feed the visceral arteries. Parallel stenting with Nellix limbs has the advantage of sealing the ruptured aorta and providing flow to both lumens.

CONCLUSIONS

The endovascular approach to a ruptured infected para-anastomotic dissected aneurysm using Nellix parallel stent grafts is technically feasible, preserving flow to the true and false lumens. This approach might be more favorable than surgery for patients with multiple comorbidities who have undergone multiple surgical procedures.

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