Endovascular coil embolization of a complex aortic arch pseudoaneurysm following arch stenting

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Abstract
Pseudoaneurysm formation is a life-threatening complication of thoracic aortic stenting due to the high risk of rupture. When located in the aortic arch, anatomic features may pose difficulties in choosing the optimal treatment strategy. Here, we describe the first poststenting aortic arch pseudoaneurysm treated by endovascular coil embolization. This approach, which we performed in a multidisciplinary setting, may be a feasible alternative in patients not considered suitable for open repair or stent-grafting. As an acute pseudoaneurysm may develop and rapidly expand during the first days after aortic stenting, early follow-up imaging is preferable.

KEYWORDS
aortic arch stenting, coil embolization, false aneurysm

INTRODUCTION
Over the last years, stent implantation has become the treatment of choice in adults with native or recurrent aortic coarctation. In addition, stenting is increasingly used to correct aortic arch obstruction due to hypoplasia or aberrant geometry of the arch. Although rare, stenting of the thoracic aorta may be complicated by acute aortic wall injury, including dissection and pseudoaneurysm formation. In this case, we illustrate that the complex anatomy associated with aortic arch pseudoaneurysms may limit standard treatment options and may therefore require an alternative, multidisciplinary approach.

CASE REPORT
A 36-year-old male presented with systolic hypertension despite treatment with three antihypertensive agents. He had a history of surgical repair of aortic coarctation by patch angioplasty during infancy. Balloon angioplasty and surgical aortoplasty were performed to treat recurrent coarctation at age 17 and 28, respectively. At age 35, two overlapping ev3 Max LD stents (ev3 Inc., Plymouth, MN) were placed for aortic arch obstruction due to pronounced gothic geometry of the arch. Because of persistent hypertension under medication, recatheterization was performed. In response to the blood pressure-lowering effect of conscious sedation, 40 μg of epinephrine was administered to reach a systolic blood pressure comparable to daily life. Although no pressure gradient was detected across the coarctation site, a pressure gradient of 25 mmHg was measured across the aortic arch. This gradient matched the most narrow and rigid aspect of the stented gothic arch. Balloon dilatation with a 22 × 20 mm Atlas PTA balloon (Bard Peripheral Vascular Inc., Tempe, AZ) at 26 atm was ineffective, showing recoil of the previously placed ev3 stents and a residual pressure gradient of 15 mmHg. Therefore, a 45 mm non-covered Cheatham-Platinum (CP) stent (NuMED Inc., Hopkinton, NY) on a 24 × 45 mm balloon-in-balloon catheter (NuMED) was implanted for additional radial strength. Although angiography showed an improved anatomical result, the elevated pressure gradient persisted. Consequently, postdilation with a 24 × 20 mm Atlas PTA balloon at 12 atm was performed, resulting in near elimination of the pressure gradient. Final angiography showed no evidence of iatrogenic aortic wall injury.

At our institution, computed tomography angiography (CTA) is routinely performed the day after aortic stenting. This CTA revealed...
a 17 × 12 mm pseudoaneurysm located ventroproximally to the addi-
tionally placed CP stent. The patient was asymptomatic. Despite the
severity of this complication, the acute risk of rupture was considered
limited due to the presence of excessive scar tissue as a result of mul-
tiple prior surgical procedures. Therefore, initial management was
conservative, consisting of serial imaging and strict heart rate and
blood pressure regulation with a systolic blood pressure target below
120 mmHg. After 4 days, CTA showed no spontaneous thrombosis of
the aneurysm. Instead, it had expanded to 20 × 14 mm (Figure 1A–C).
Therefore, it was decided to perform endovascular coiling of the pseudo-
aneurysm. Under general anesthesia, a 6 Fr sheath (Glidesheath Slender,
Terumo Corp., Tokyo, Japan) was inserted into the right brachial artery.
A 6 Fr RDC guiding catheter (Boston Scientific Corp., Marlborough, MA)
was then advanced, accommodating a 45° PX SLIM AQUA catheter (Cordis
Corp., Fremont, CA). Subsequently, a 45° Headway 17 microcatheter
(MicroVention Inc., Aliso Viejo, CA), 8 additional coils (Ruby Coil, Penumbra
Inc.) were placed (Figure 2C,C',D). Follow-up imaging at 6 months
showed a good result with complete closure of the pseudoaneurysm
(Figure 3). The patient was normotensive, although still on antihyperten-
sive medication.

FIGURE 1  Three-dimensional reconstruction of the follow-up CTA performed after additional CP stent implantation, displayed in frontal (A), lateral (B), and cranial (C) planes. Note the 20 × 14 mm pseudoaneurysm located ventroproximally to the CP stent (yellow arrows). CP, Cheatham-
Platinum; CTA, computed tomography angiography [Color figure can be viewed at wileyonlinelibrary.com]
Currently, the timing of follow-up imaging after aortic stenting varies widely across institutions. Although AHA/ACC guidelines state that postinterventional imaging is recommended, no timing interval is provided. As demonstrated by this case, aortic wall injury may not be present or recognized at the end of the stenting procedure, but instead develop during the first days after the procedure. In our opinion, this underlines the importance of routine CTA early after stent implantation, preferably before hospital discharge. Prospective studies are needed to determine the optimal timing of follow-up imaging after aortic stenting.

4 | CONCLUSION

An aortic arch pseudoaneurysm is a rare and anatomically challenging complication of aortic stenting. In this report, we show that endovascular coil embolization may be a feasible alternative option when the patient is not suitable for open repair or stent-grafting.

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CONFLICT OF INTEREST

The authors have no conflict of interest to disclose.

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