Transcatheter management of proximal stent migration in coarctation of the aorta

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ABSTRACT

Proximal stent migration in setting of transcatheter management of coarctation of the aorta is a rare complication, which may require emergency surgery. Herein, we report a successful transcatheter management of proximal stent migration in a high surgical risk, a 14-year-old girl, which caused partial occlusion of both the descending aorta and the left subclavian artery.

Keywords: Aortic arch, coarctation of the aorta, stent migration

INTRODUCTION

Coarctation of the aorta accounts for 6%–8% of congenital heart diseases, and the narrowing is mostly located distal to the left subclavian artery (LSA). Transcatheter stent implantation has emerged as a treatment option for native or recurrent coarctation, provided that the stent can be expanded to adult size.[1] Stent migration is a possible complication of the procedure and has been reported in 5% of cases,[2] mainly to the descending aorta and, less frequently, proximally to the aortic arch. Proximal migration of stent may require emergency surgery for its removal.[3,4] Our case was complicated by proximal stent migration that caused both iatrogenic coarctation and partial LSA occlusion, which was successfully managed by transcatheter intervention in a high-surgical risk patient.

CLINICAL SUMMARY

A 14-year-old girl with native coarctation of the aorta was admitted for percutaneous stent implantation. The coarctation was postductal, close to the emergence of the LSA. At the age of 7 years, she was diagnosed with *Staphylococcus schleiferi* endarteritis at the coarctation site, complicated by the formation of a small mycotic aortic aneurysmatic dilation just above the isthmus [Figure 1]. During follow-up, despite triple antihypertensive therapy, her blood pressure remained above the 95^{th} percentile. On admission, her upper/lower limb blood pressure gradient was 30 mmHg; she weighed 102 kg with a body mass index (BMI) of 43.5 Kg/m^2. Cardiac catheterization was performed through the right femoral artery, the peak-to-peak pressure gradient between the aortic arch and the descending aorta was 35 mmHg, and the angiography in the ascending aorta revealed the following measures: aortic arch 16 mm, aneurysmatic dilation 18 mm, coarctation site 8 mm, abdominal aorta (diaphragmatic level) 16 mm, and distance from LSA to coarctation site 18 mm.

A guidewire was left in the ascending aorta and a 22-mm covered CP stent (B. Braun®, United States) mounted on a 12/40-mm POWERFLEX PTA balloon (Cordis®, United States) was percutaneously implanted, however, it landed slightly above the coarctation site [Figure 2]. We then implanted a second 22-mm covered CP stent (B. Braun®, United States) mounted on a 16/40-mm TYSHAK balloon (BVM®, United Kingdom) within the first stent and slightly below it. In doing so, both the

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stents migrated proximally as a unit to the distal aortic arch, which in turn led to iatrogenic coarctation of the aorta and partial occlusion of the LSA. Despite several attempts, we were unable to retrieve it by snaring. After the procedure, there was an evident right/left upper limb blood pressure gradient of 20 mmHg and a right upper/lower-limb blood pressure gradient of 40 mmHg. Postprocedure transthoracic echocardiography revealed a peak continuous Doppler gradient between the aortic arch and the descending aorta of 90 mmHg with diastolic runoff. Thoracic angio-computerized tomography showed the stents in the emergence of the LSA, partially obstructing blood flow to the descending aorta [Figure 3].

Left-heart catheterization was carried out again the next day. The peak-to-peak pressure between the aortic arch and the descending aorta was 60 mmHg. A guidewire was advanced through the femoral artery and through the stents, which was placed in the LSA. However, we were not able to pass another guidewire into the aortic arch retrogradely. Instead, a guidewire was passed, through

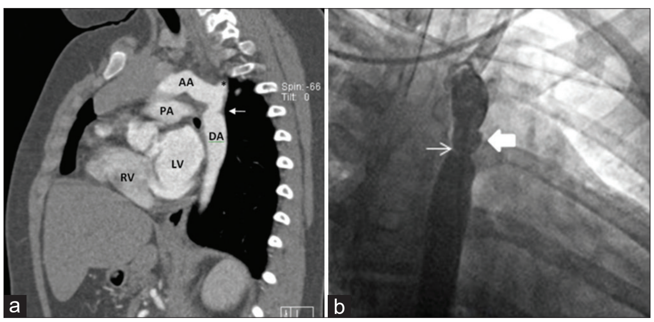

Figure 1: (a) Thoracic angio-computerized tomography, multiplanar reconstruction (sagittal anterior left view). (b) Angiography (Left anterior view).*Left subclavian artery; Thin arrow – coarctation site; Thick arrow – aortic mycotic aneurysm; AA: Aortic arch, DA: Descending aorta, LV: Left ventricle, PA: Pulmonary artery, RV: Right ventricle

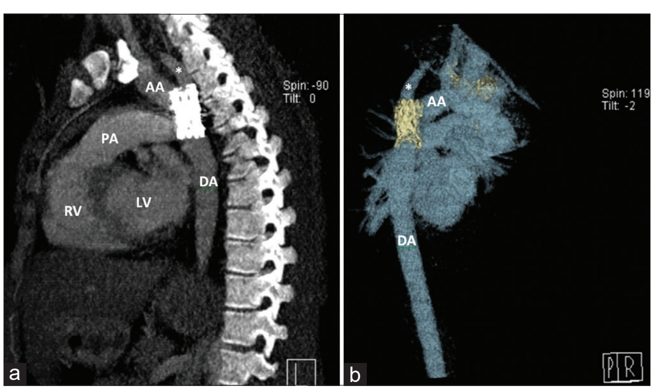

Figure 3: Thoracic angio-computerized tomography. (a) Multiplanar reconstruction (sagittal right posterior view). (b) 3D reconstruction. CP stent migration to emergence of the left subclavian artery, partially obstructing both the left subclavian artery and the aortic arch to the descending aorta. *Left subclavian artery; AA: Aortic arch, DA: Descending aorta, LV: Left ventricle, PA: Pulmonary artery, RV: Right ventricle

the right radial artery, through the stents, which was then snared with an EN Snare (Merit Medical®, United States), thus creating an arterial loop. We then proceeded with simultaneous balloon dilations of increasing sizes, one in each artery, to flare the proximal part of the embolized stent. An optimal result was achieved with a 12/45-mm Conquest balloon (BD®, United States) inflated to 25 atm in the aortic arch and a 10/45-mm Conquest balloon (BD®, United States) inflated to 20 atm in the LSA [Figure 4]. The peak-to-peak pressure at the end of the procedure was 19 mmHg. During follow-up, it has been possible to control the blood pressure with two drugs, and there is no pressure gradient between the upper and lower limbs nor between the right and left arms.

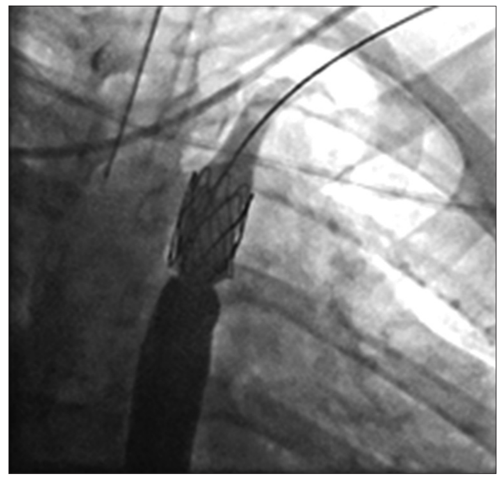

Figure 2: Angiography (left anterior view). Angiography after implantation of the first stent placed slightly above the coarctation site

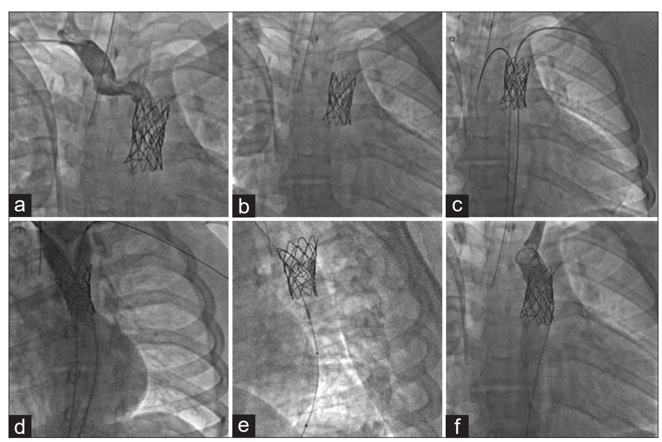

Figure 4: Angiography. Steps to the flaring of the proximal part of the stent. (a) Angiography in the aortic arch showing occlusion to the descending aorta; (b) Embolized CP stents; (c) Two guidewires, through the stents, one in the aortic arch and the other in the left subclavian artery. (d) Simultaneous inflation of a 12/45-mm Conquest balloon (BD®, United States) in the aortic arch and a 10/45-mm Conquest balloon (BD®, United States) in the left subclavian artery. (e) Proximal part of the stent flared. (f) Final angiography in the aortic arch showing unobstructed passage of contrast to the descending aorta

DISCUSSION

Transcatheter stenting of adult and adolescent coarctation of the aorta is considered the treatment of choice for this entity.[5] Stenting has the advantages of a lower recurrence rate, lower incidence of aneurysm formation, and superior immediate relief of the pressure gradient when compared with balloon angioplasty.[6]

Stent migration has a reported incidence of 5%, and it has been postulated to be more common when the delivery balloon catheter is larger than the aorta proximal to the coarctation site.[2] Retrospectively, the use of a temporary pacemaker for rapid pacing during deployment of the first stent could have prevented it from landing above the coarctation site. Once the first stent was implanted above the coarctation site, the mycotic aneurysm may have facilitated the proximal stent migration when we implanted the second stent. Another risk factor to the embolization was the closeness between the coarctation site and the LSA, as well as the vertical trajectory of the former.

As recommended, we used covered stents in case of aortic rupture. As a result, when the covered stent migrated proximally, it caused a severe iatrogenic coarctation, as well as partially obstructing the origin of the LSA. Surgical retrieval of the stent and aortic arch reconstruction is often the only management option.[3,4] However, our patient had a BMI of 43.5 Kg/m^2 and several comorbidities, thus the surgical risk was too high. We firstly considered a previously reported technique by inflating a balloon to capture the stent and retrieving it toward the descending aorta.[7] However, the stent was well adherent to the aortic wall, and we ran the risk of dislodging the other stent, thus the attempt was abandoned. Another option was to snare the distal part of the stent and repositioning it, with or without further stent implantation for better stability.[8,9] However, as there were two stents, the risk of dislodging the second stent was considerable. We thus opted to balloon flare the proximal part of the migrated stent by simultaneously dilating two balloons as described above. Although we performed simultaneous sequential dilations with balloons of increasing sizes, we were only successful when we used very high-pressure balloons.

Proximal stent migration is a possible complication of the percutaneous treatment of coarctation of the aorta. The surgical risk of removing the stent from the distal aortic arch in a severely obese patient is too high, and transcatheter management is an alternative management option. We highlight a different approach in the percutaneous treatment of these cases, particularly when the stent also occludes a vessel of the aortic arch.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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