Endovascular management of pseudo-aneurysms after previous surgical repair of congenital aortic coarctation

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Abstract

Objective: Whatever the surgical technique used, false aneurysm formation is one of the long-term complications of repair of aortic coarctation. Conservative management is associated with a 100% rate of rupture. The conventional surgical approach is complex and associated with high morbidity and mortality rates. We report our experience of endovascular management of pseudo-aneurysms after previous surgical repair of congenital aortic coarctation.

Methods: Between October 2005 and 2006, stent-grafting of pseudo-aneurysms after previous surgical repair of congenital aortic coarctation was performed in four patients. Median age was 31.5 years (range: 24—38). Two patients had undergone two previous interventions. The last previous surgery consisted of graft interposition (N = 2), subclavian flap aortoplasty (N = 1) and aorto-aortic bypass (N = 1). Median size of the pseudo-aneurysm was 31.5 mm (range: 20—58). Mean time between the last surgery and endovascular treatment was 24 years (range: 3—32). One patient was treated emergently because of hemoptysis in relation with an aorto-bronchial fistula, the three other patients were treated electively. A transfemoral approach was used in all patients. The Zenith TX2™ (Cook) thoracic stent-graft was used in all the patients, one patient underwent previous dilatation at the coarctation level. When present, the ostium of the left subclavian artery was always covered (N = 3).

Results: No major complication occurred during the procedure and no patient died during the follow-up. One patient presented a type II endoleak which spontaneously healed during the first month. Another patient with his left subclavian artery covered presented claudication of the left arm requiring a carotid-subclavian bypass. After a median follow-up of 7.5 months (range: 1—12.9), the patients were asymptomatic and CT scans demonstrated complete exclusion of all treated postcoarctation aneurysms without recoarctation and without any stent-graft-related complication.

Conclusions: The endovascular management of pseudo-aneurysms after previous surgical repair of congenital aortic coarctation is feasible. This approach was safe and effective. Long-term clinic and imaging follow-up is mandatory.

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1. Introduction

Open surgical repair of coarctation remains the gold standard, but whatever the surgical technique used and despite excellent primary results, 3—38% of the patients develop long-term anastomotic pseudo-aneurysms [1,2] with a rupture-related mortality of 7% (Cohen). Redo surgery is challenging and mortality rate is significant [2—4]. Endovascular management has been recently proposed as an encouraging alternative therapeutic option [5—8]. We report our experience of endovascular treatment of pseudo-aneurysms at the level of previous coarctation repair.

2. Patients and methods

From October 2005 to 2006, four patients (three male and one female) with postcoarctation pseudo-aneurysms were referred to Montreal Heart Institute. The preoperative data are indicated in Table 1. Median age was 31.5 years (range: 24—38).

One patient presented hemoptysis in relation with a bronchial aortic fistula. Even if hemodynamically stable, he was treated emergently. The three other patients were asymptomatic and were treated electively.

Two patients had already been reoperated at the level of the coarctation repair because of a ruptured pseudo-aneurysm and a recoarctation. All presented an anastomotic pseudo-aneurysm with a median size of 31.5 mm (range: 20—58). The previous surgery consisted of graft interposition (N = 2) (after prosthetic patch in one case and after subclavian flap in another case), subclavian flap aortoplasty...
(N = 1) and aorto-aortic bypass (N = 1). Mean time between the last surgery and endovascular treatment was 24 years (range: 3—32).

All patients had preoperative thoracic spiral CT angiographies and written informed consent was obtained from all patients. The endovascular devices used were the Zenith TX2® (Cook, Brisbane, Australia). The graft diameter was oversized by 10—15% compared with the proximal and distal normal aortic diameters to achieve an optimal friction seal.

Endovascular stent placement procedures were performed under general anaesthesia. All the patients received an intravenous bolus of heparin at the dose of 75 UI/kg. A large spectrum prophylactic antibiotic (cefuroxime 1500 mg IV die) was systematically given during the procedure and maintained for 24 h following the procedure. The whole procedure was monitored with digital subtraction angiography and transoesophageal echocardiography.

In all the cases, the delivery system was inserted over 2.60 cm long guide wire (Back-Up Meier; Boston Scientific, Oakland, NJ) through a transverse arteriotomy of the right common femoral artery (median diameter 9 mm (range: 6.5—10)). The Zenith TX2® (Cook, Brisbane, Australia) thoracic stent-graft was used in all patients, one patient underwent previous dilatation at the coarctation level with a XXL Coda Balloon (Cook, Brisbane, Australia).

Per operative data are indicated in Table 1. All the procedures were carried out in the operating room of the interventional radiology department. The procedures themselves involved a multidisciplinary team which was composed of cardiovascular surgeons, interventional radiologists and anaesthesiologists. The patients were extubated immediately after the procedure and supervised in the intensive care unit during the first 24 h. Preventive anticoagulation was maintained for 48 h and then followed by aspirin (250 mg/day).

The follow-up consisted of carrying CT scans before discharge, at the 1st, 3rd, 6th, 12th, 18th months and yearly.

### 3. Results

Peroperative and postoperative outcomes are indicated in Table 1. Transfemoral stent-graft deployment was uneventful and technically successful in the four patients. No patient died and no patient presented any neurological complication. Postdeployment angiography demonstrated the exclusion of the false aneurysms without any endoleak in four patients. A mild type II endoleak from the first intercostal artery was detected in one patient and confirmed on CT scan, the endoleak spontaneously healed after 1 month. When present (N = 2), the ostium of the left subclavian artery was covered. One patient presented claudication of the left arm requiring a secondary left carotid-subclavian bypass. All patients were discharged from the hospital within 1 week. After a median follow-up of 7.5 months (range: 1—12.9), the patients were asymptomatic and contrast-enhanced CT scans confirmed the exclusion of all endovascularly treated postcoarctation aneurysms without recoarctation and without any stent-graft-related complication. All the postcoarctation aneurysms shrank and no further dilatation were detected at follow-up (Fig. 1).

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Age (years)</th>
<th>Gender</th>
<th>Comorbidities</th>
<th>Previous surgery and type of surgery</th>
<th>Size of the pseudo-aneurysms (mm)</th>
<th>Symptons</th>
<th>Procedure</th>
<th>Stent-graft and follow-up</th>
<th>Postoperative course</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>32</td>
<td>Male</td>
<td>None</td>
<td>Prosthetic patch Hemoptysis</td>
<td>20 mm</td>
<td>Asymptomatic</td>
<td>Emergent</td>
<td>Cook Zenith TX2® 30 mm × 80 mm</td>
<td>12.9 months</td>
</tr>
<tr>
<td>2</td>
<td>32</td>
<td>Male</td>
<td>None</td>
<td>Left subclavian flap</td>
<td>20 mm</td>
<td>Asymptomatic</td>
<td>Elective</td>
<td>Cook Zenith TX2® 30 mm × 80 mm</td>
<td>11.1 months</td>
</tr>
<tr>
<td>3</td>
<td>24</td>
<td>Male</td>
<td>None</td>
<td>Aorto-aortic bypass</td>
<td>20 mm</td>
<td>Asymptomatic</td>
<td>Elective</td>
<td>Cook Zenith TX2® 24 mm × 77 mm</td>
<td>1.8 months</td>
</tr>
<tr>
<td>4</td>
<td>Female</td>
<td>None</td>
<td>Morbid obesity</td>
<td>Aorto-aortic bypass</td>
<td>20 mm</td>
<td>Asymptomatic</td>
<td>Elective</td>
<td>Cook Zenith TX2® 28 mm × 120 mm</td>
<td>1 month</td>
</tr>
</tbody>
</table>
4. Discussion

Whatever the technique used for surgical repair of congenital aortic coarctation, long-term complications are not uncommon [9–11]. The incidence of aneurysm formation is increasing with time reaching 17% after subclavian flap angioplasty, 5–28% after Dacron-patch aortoplasty, 6% after tube graft repair and 3% after end-to-end anastomosis [1,12].

Conservative treatment of aneurysms after surgical coarctation repair is unacceptable. Knyshov et al. [2] reported a 100% rate of rupture within 15 years, while Cohen et al. [3] reported aortic-related death in 7% of patients with previous history of surgical repair of congenital aortic coarctation. On the contrary, redo surgical repair of post-surgical complication carries significant mortality (14–23%) and morbidity, including paraplegia, bleeding and paralysis of the recurrent nerve [2,4,13,14]. Many questions regarding the safest approach for recurrent coarctation and management of its long-term complications have been raised. Taking into account the encouraging results of endovascular repair of atherosclerotic thoracic aortic aneurysms [15], the endovascular procedures appear attractive and four groups have previously reported limited series of endovascular management of postcoarctation pseudo-aneurysms [5–8].

Like other authors, none of our patients died or experienced any major complication underlining the endovascular management is less invasive even in emergency. Moreover, these young patients may present less risk for neurological complication: first, the upstream and downstream aorta is normal in these young patients preventing from embolization from the aortic arch secondary to the manipulation of the guide wires; second, the covered aortic portion is rather proximal and limited in length. Nevertheless, three specific technical problems can be discussed: the management of the left subclavian artery, the vascular access and the possible association of recoarctation and pseudo-aneurysms.

The left subclavian artery had been used as a patch aortoplasty in one of our patients. In the three other cases, the ostium of the left subclavian artery had to be covered to achieve complete exclusion of the neck of the pseudo-aneurysm. As the right vertebral artery and the circle of Willis were patent on perioperative angiography, no previous carotid-subclavian bypass was performed. Mild postprocedural drop in ipsilateral systolic brachial pressure was observed in all the cases and only one patient presented left arm claudication requiring postoperative extraanatomic bypass confirming that secondary transposition of the left subclavian artery is rarely necessary [16].

The vascular access in patients with previous history of coarctation may be another problem linked with often small ilio-femoral arteries in the setting of history of congenital aortic coarctation. The insertion of the drooping device and transfemoral stent-graft deployment was uneventful and technically successful in the four patients. Even when small (6.5 mm) iliofemoral junction was encountered, the 21-Fr sheath could be inserted and advanced without any difficulty, in young patients with supple arteries.

Last but not least, as reported by Preventza et al. [8], the association of recoarctation and pseudo-aneurysm may be challenging. Primary stent implantation has been suggested as a potentially superior alternative to angioplasty alone in
case of native coarctation [17]. In case of patients presenting with pseudo-aneurysm and recurrent coarctation, the combination of dilation at the recurrent stenosis site, stent-grafting and Palmaz stent placement inside the stent-graft at the level of recurrence has been proposed [8]. The use of stent-grafts with strong radial force like the Zenith TX2® (Cook) after previous dilatation may be an alternative especially when no gradient exists within the stent-graft.

As stent-graft placement in thoracic aorta is associated with low mid-term complication rates, the use of stent-grafts in younger patients after coarctation surgery may be justified [16,18—19]. Endoluminal repair seems to be a feasible, safe and promising less-invasive alternative compared with redo operations for post-surgical thoracic aneurysms secondary to coarctation repair. Nevertheless, clinic and imaging long-term follow-up is absolutely necessary to assess the durability of stent-graft repair and to detect possible long-term complication, particularly long-term endoleak. MR imaging may be an interesting alternative to follow these rather young patients to limit the exposure to radiation.

References


