Abstract

Objectives: Late aneurysm formation has been reported after every type of surgical coarctation repair in up to 10%, with rupture of such aneurysms being responsible for approximately 7% of all deaths. Secondary surgical repair carries a significant mortality (up to 15%) and morbidity rate (recurrent laryngeal nerve paralysis ~20%, phrenic nerve injury ~5%). According to the positive experience with endovascular therapy of atherosclerotic thoracic aortic aneurysms, it is worthwhile to evaluate the concept of minimally invasive endovascular stent grafting for secondary repair of postsurgical aneurysms. Methods: Data were collected prospectively on consecutive patients who presented with postcoarctation false aneurysms. Results: Since 1999, in a cohort of 210 endovascularly treated patients with thoracic and thoracoabdominal aortic pathologies, four patients with postcoarctation false aneurysms underwent endoluminal stent-graft placement. All of these procedures were technically successful without 30-day or one-year procedure-related mortality. After a follow-up of 71 months in median (range, 7–93 months; mean, 60.5 months), all aneurysms remain excluded without any endoleak. Conclusions: According to the current limited experience of small series, the endoluminal repair seems to be a promising alternative to redo open operations for postsurgical thoracic aneurysms associated with coarctation repair. Long-term follow-up of our small cohort confirmed the durability of the stent-graft treatment.

Keywords: Coarctatio aortae; Pseudoaneurysm; Aortic aneurysm; Endovascular repair

1. Introduction

After surgical repair of coarctation during childhood or adolescence the patients are considered as cured for the consecutive lifespan. However, long-time follow-up of these patients demonstrated late problems as recoarctation, hypertension, and premature coronary and cerebrovascular disease, resulting in increased morbidity and mortality [1]. Additionally, despite the primary surgical success, approximately 10% of affected patients experience a localized formation of postsurgical aneurysms in the long-term follow-up [2], with the rupture of those aneurysms being responsible for death in about 7% [3]. The mean delay between coarctation repair and false aneurysm formation is often more than 12 years [2].

The endovascular stent-graft repair has been shown to be viable for atherosclerotic aneurysms with promising results [4–6]. Therefore, it seems to be worthwhile to prove the concept of endovascular repair for anastomotic aneurysms to avoid repeat surgical intervention. The aim of this article is the evaluation of this method in four cases of postcoarctation aneurysms.

2. Patients and methods

Since November 1999, thoracic aortic pathologies in 190 patients have been treated endovascularly due to the following aortic pathologies: aneurysm, 110 patients; chronic dissections with aneurysm, 27 patients; acute dissection without aneurysm, 20 patients; intramural hematoma, four patients; penetrating ulcers, 17 patients; traumatic aortic rupture, six patients; and iatrogenic false aneurysm, six patients.

Four male patients underwent endovascular repair of false aneurysm after previous surgical coarctation repair (Table 1).

The first patient suffered from progressive dyspnea. He had had an end-to-end repair of an aortic coarctation at 15 years of age and which required a redo operation with a Dacron graft interposition at 42 years of age due to re-coarctation. At the present admission, the contrast-enhanced computed tomographic CT-scan revealed a false aneurysm localized distally to the origin of the left subclavian artery. The bronchoscopy showed compression of the left main bronchus. He was treated immediately within 24 h after admission to our institution.

The second patient was asymptomatic and he was transferred to our center with a diagnosis of a type 1 endoleak after stent-graft placement (Talent Thoracic Stent Graft System; Medtronic Ave, Sunrise, FL, USA; 28x28/113) at an
outside cardiovascular unit. He had received a graft interposition 21 years ago for repair of aortic coarctation. The contrast-enhanced CT-scan demonstrated the endoleak, which was confirmed by intraoperative angiography.

The third patient had a patch angioplasty at 13 years of age and presented now with thoracic and interscapular pain. A 55 mm thoracic false aneurysm was revealed through contrast-enhanced CT-scan. Fig. 1 shows his aneurysm in the intraoperative angiography.

The fourth patient was only eight years of age when receiving a patch angioplasty of an aortic coarctation. Thirty-six years later, he suffered from thoracic pain. The contrast-enhanced CT-scan showed a false aneurysm of 70 mm in diameter.

All patients received preoperative thoracic spiral CT-angiographies; in the three patients treated electively, the diagnostics were completed by digital subtraction angiographies of the aorta. The endovascular devices used in our patients were the Talent Thoracic Stent Graft System in one patient and the Gore TAG Thoracic Endoprosthesis in 2, respectively the GORE C-TAG Thoracic Endoprosthesis (W. L. Gore and Associates, Flagstaff, AZ, USA) in one patient. To achieve a tight friction seal, the graft diameter was oversized by 10%.

Before the endovascular aneurysm repair, informed consent was obtained from all patients, and a team of vascular surgeons performed the endovascular procedures after achievement of peridural anesthesia, as previously described [7]. Follow-up spiral CT-scans were performed at three, six, and 12 months and then yearly thereafter in our outpatient clinic. Fig. 2 shows the first postoperative CT-scan of the third patient.

3. Results

Transfemoral stent-graft deployment was uneventful and technically successful in all four patients. No patient died. No patient suffered from paraplegia. Postdeployment angiography confirmed the exclusion of the false aneurysm without any endoleak in all patients. In one patient, local dissection of the common femoral artery was repaired by endarterectomy and patch angioplasty. All of the patients had intended covering of the subclavian artery and none of them became symptomatic. Although the placement over
the ostium of the left subclavian artery led to a 50% reduction of distal artery pressure, none of them required revascularization of the left arm.

All four patients were discharged from the hospital within one week.

The mean follow-up was 60.5 months. Until now, contrast-enhanced CT-scan confirmed the exclusion of all endovascularly treated postcoarctation aneurysms without stent-graft migration and without any endoleak.

4. Discussion

Late aneurysm formation has been reported after every type of surgical coarctation repair. The incidence of aneurysm formation is increasing with time. Although a postsurgical aneurysm was observed in 17% after subclavian flap angioplasty, reports of late aneurysm formation after Dacron patch angioplasty range from 5% to 38% of cases [8]. Similarly, tube graft repair or end-to-end anastomosis is followed by postcoarctation false aneurysm rates of 6% and 3%, respectively [2]. The rupture of such aneurysms is thought to be responsible for approximately 7% of all deaths of the long-time survivors after surgical repair [3, 7].

There is only one single-center experience with conservative treatment of aneurysms after surgical repair of coarctation, which reported a 100% rate of rupture within 15 years [9].

Alternatively, repeated open surgery repair carries a significant mortality and morbidity, including paralysis of the recurrent nerve, bleeding, and paraplegia [10–12].

According to the promising experience with the endovascular treatment of atherosclerotic thoracic aortic aneurysms, it is rather attractive to evaluate the concept of minimally invasive endovascular stent grafts for secondary repair of post-coarctation false aneurysms.

The systematic bibliographic PubMed research documented that other groups have used this approach (Table 2).

A complete analysis of the PubMed literature about endovascular therapy of postcoarctation aneurysms showed that the technical success was 100% and only one case of death and one case of paraplegia have been reported [19]. The case of death occurred on the 5th postoperative day after the implantation of the stent-graft with coverage the left subclavian artery (LSA) [19]. Prior to the already scheduled embolization of the LSA the patient died suddenly, probably due to rupture of the aneurysm because of a type 2 endoleak through the LSA [19].

The patient who suffered from transient paraplegia already presented with this symptom, and thus it was not a result of the TEVAR. It was most likely caused by an intramural hematoma affecting the artery of Adamkiewicz [19].

To sum it up, all aneurysms stayed excluded without endoleak after follow-up times ranging from six to 44.5 months.

Our own experience extends the currently existing results with small case loads and short follow-up and adds a long-time follow-up of 60.5 months.

To really prove the advantage of the endovascular method it would need a prospective randomized trial comparing this method with open surgical repair. Regarding the very few numbers of patients, a European multicenter study would be needed.

The strategy of spinal cord protection still remains to be discussed. None of our patients got revascularization of the LSA and none suffered from symptoms of ischemic spinal cord. Our decision not to revascularize the LSA was mainly influenced by three factors: the young age of the patients, the demonstration of a strong right vertebral artery in the angiography and a quite short section of the thoracic aorta stented, and therefore few spinal cord arteries to be overstented [24].

We conclude that the TEVAR is a promising and a less-invasive alternative to the high-risk second open surgical repair of postcoarctation false aneurysms. Our long-time follow-up with cross-sectional CT-scans indicates the efficacy and durability of the stent-graft as therapeutic concept in this entity of aortic diseases.

Table 2. Overview of the world-experience with endovascular repair of pseudoaneurysms after surgery because of coarctation in the childhood – results of PubMed research. Case reports are not listed in the references

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