Complications after endovascular repair of Stanford type A (ascending) aortic dissection

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Abstract

Endovascular treatment has emerged as a less traumatic alternative treatment for several diseases of the thoracic aorta. However, the complications of the endovascular management of ascending aortic dissections are still high. We present a case of two iatrogenic complications after endovascular repair (EVAR) of type A (ascending) aortic dissection. Retrograde aortic dissection at the proximal part of the aortic endovascular graft and a guidewire-induced iatrogenic left ventricular pseudoaneurysm were presented in this patient after the stent-grafting procedure. Fourteen months later, surgical replacement of the ascending aorta and proximal arch was performed and the left ventricular pseudoaneurysm was treated successfully by linear closure. The patient recovered uneventfully. Although aortic endovascular grafting is apparently less traumatic, indications and potential complications related to the stent graft should be considered with great care.

Keywords: Aortic dissection • Endovascular surgery • Complication

INTRODUCTION

Aortic dissection is most often a complex and catastrophic event which, if untreated, can be potentially life-threatening. Open surgical procedure is the current strategy, but this surgery is associated with significant morbidity and mortality. Recently, endovascular graft repair has emerged as an apparently less traumatic alternative to conventional surgery for the treatment of these lesions, such as aortic type B dissection, subacute type A dissection, penetrating ulcer and stent-graft coverage of the primary intimal tear, but certainly not for acute type A dissection. However, endoluminal treatment is not without complications. We report a case of two iatrogenic complications that occurred after endovascular repair of a type A (ascending) aortic dissection.

CASE PRESENTATION

A 61-year old woman was admitted to our department due to a progressive aneurysm in the proximal ascending aorta and a left ventricular pseudoaneurysm. She had undergone endovascular repair of a type A aortic dissection localized to the ascending aorta at another hospital 14 months previously. In her previous operation, a stent graft was deployed in the ascending aorta, above the coronary arteries and great vessels (Fig. 1A). Postoperative recovery was uneventful. The patient was discharged in a stable condition 8 days after the procedure. A follow-up computed tomographic angiogram at 3 months revealed a new tear at the proximal end of the stent graft and a large left ventricular pseudoaneurysm formation. An echocardiogram performed demonstrated dilatation of the ascending aorta and confirmed the diagnosis of the pseudoaneurysm of the anterolateral wall. Considering the patient presented with haemodynamic stability and no clinical sign of discomfort, she opposed an open surgery and opted for medical treatment. Two weeks previously, the patient complained of persistent chest and back pain. Further echocardiography and computer tomographic images revealed a progressive dilatation of the ascending aorta, a maximum diameter of the ascending aorta of 55 mm and a large aneurysm arising from the lateral wall of the left ventricle (Fig. 1B). Because of the symptoms and imaging suggestive of progression of aortic disease, open surgical repair was scheduled. The patient was operated on using hypothermic cardiopulmonary bypass and antegrade cerebral perfusion through the right axillary artery. Intra-operatively, dense pericardial adhesions all around the heart and an expanding ascending aorta were found. Once the ascending aorta was opened, an entry tear was identified in the proximal uncovered stent of the endovascular graft, but the aortic valve was functioning well (Fig. 1C). The primary entry tear of the aortic dissection was excluded from the true lumen flow by the covered portion of the endovascular graft. After removing the stent graft, the ascending aorta and proximal arch were replaced with a polyethylene terephthalate fibre graft. Then, we proceeded to the opening of the LV pseudoaneurysm and to the identification of the hole linked to the left ventricle (Fig. 1D).
The LV pseudoaneurysm was repaired by linear closure. The patient recovered uneventfully and was discharged 2 weeks after the surgery. No complications were found on the regular follow-up.

**DISCUSSION**

Aortic dissection is the most life-threatening disease in cardiovascular surgery, especially when the entry tear is situated in the ascending aorta (Stanford Type A). Cardiac surgery with cardiopulmonary bypass and, if necessary, deep hypothermia is the gold standard when treating ascending aortic aneurysm or dissection [1]. Endovascular management of the aortic arch and descending thoracic aortic aneurysms or dissections is routinely performed in many vascular centres. Owing to the significant morbidity and mortality of cardiac surgery, some attempt to perform endovascular stent-graft treatments of complex lesions that were formerly considered to be contraindicated (e.g. Stanford Type A aortic dissection, the entry tears are sited in the ascending aorta).

To date, a number of reports had described endovascular stent grafting of various pathologies, including deployment of a fenestrated stent graft to repair an ascending aortic dissection or ascending aortic pseudoaneurysm; most of these descriptions of successful stent graft treatment had been limited to isolated case reports and small clinical series [2, 3]. However, several complications directly related to the stent graft or as a result of manipulations of delivery systems, which may lead to emergency surgery or even a fatal outcome, should be applied cautiously.

Retrograde aortic dissection was regarded as one of the common complications of endovascular stent grafting for type B dissection with an incidence of 1.4–20%. This complication could be attributed to mixed causes, including the fragility of the aortic wall and disease progression as the pathological background and stent grafting-related factors [4]. In our patient, the proximal part of the aortic endovascular graft had created a tear in the aortic wall resulting in a retrograde aortic dissection. Although no data are yet available to compare this complication in different segment of the aorta, we believe that placement of the stent graft at the ascending aorta was deemed to more predispose to cause intimal defects than the descending thoracic aorta because the stent deployed in the ascending aorta might exert a strong radial force to strengthen the proximal fixation due to the high-velocity pulsatile flow. Furthermore, no dedicated grafts have been developed for the ascending aorta. The stent graft designed for the descending aorta have multiple limitations and are not suitable for ascending aorta repair. Finally, the stent deployed in the ascending aorta further bears the risk of compromising the aortic valve, the coronary arteries, and the...
supra-aortic vessels due to the special anatomy of the ascending aorta. Therefore, endovascular therapy for the treatment of ascending aortic pathology has remained controversial.

An LV pseudoaneurysm, which was found by duplex ultrasonography on regular follow-up and was also identified during the operation, was another complication in our patient. An LV pseudoaneurysm typically occurs as a rare complication of myocardial infarction. It is also seen rarely after surgery, trauma, or infection as well as after myocardial infarction when the cardiac rupture is limited by pre-existing adhesions between the epicardium and the pericardium. Vanezis et al. [5] reported that an LV pseudoaneurysm even occurred after an apical approach TAVI in an elderly lady with severe aortic stenosis. In our patient, however, the guidewire manipulation during the intervention seems to be the most probable cause, as the coronary arteriography shows no coronary changes previously. We postulate that the stiff wire passed through the aortic valve to park in the left ventricle and perforated the wall of the left ventricle. The patient did not undergo a heart tamponade, probably because of its slow formation. To avoid this iatrogenic complication during endovascular graft implantation, the design of the stent graft system should be improved; in particular, the development of a device specific for ascending aortic pathology is worth considering because currently available devices are designed mainly for the descending thoracoabdominal aorta. In addition, standardized endovascular manipulation cannot be overemphasized.

To date, a handful of reports, most of these are isolated case reports and small clinical series, have described successful stent graft treatment of type A aortic dissection. This represents the advances in our understanding and ability to treat ascending aortic pathology using endovascular techniques. Although the main benefit of this approach is its minimally invasive fashion, avoiding sternotomy as well as circulatory arrest, potentially lethal complications, both acute and delayed, may arise [2]. We must be careful in the evaluation and selection of patients, and we must avoid the overly enthusiastic adoption of this technology. Stent grafting of the ascending aorta is technically feasible but should be reserved for selected high-risk patients with advanced age and multiple comorbidities only. Cardiac surgery with cardiopulmonary bypass is still the gold standard to treat ascending aortic aneurysms. Endovascular treatment of type A aortic dissection is evolving. Further refinement and development of disease-specific endoprosthesis will permit the treatment of various thoracic aortic pathologies, including the ascending aorta in the near future.

Conflict of interest: none declared.

REFERENCES