

Total Thrombosis of Bifurcated Endoprosthesis: A Rare Complication of Endovascular Treatment of Abdominal Aortic Aneurysm

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Abstract

Background: Aortic stents are a therapeutic alternative to open surgery of abdominal aortic aneurysms. We report a case of treatment of an abdominal aortic aneurysm with a bifurcated stent, complicated by total thrombosis. Aim: The purpose of this presentation was to understand the causes, mechanisms, incidents and accidents that contributed to this complication. Case Presentation: A 48-year-old man patient with a history of high blood pressure, ischemic heart disease, chronic obstructive pulmonary disease, who was found during a surveillance check-up, an infra-renal abdominal aorta aneurysm measured at 56 mm in diameter, asymptomatic but progressive. The indication of an endovascular treatment by the placement of a bifurcated prosthesis was posed and accepted. Thrombosis of the two limbs was intra-operative, upper-end migration without endoleak at 4 months postoperative, total thrombosis of the stent at 13 months postoperatively. Explantation of the stent followed by aortobi-iliac bypass was finally performed in the 15th month. Conclusion: The cardiopulmonary antecedents, the anatomical and evolutionary characteristics of the aneurysm could have played a role in the occurrence of the complications observed in this patient.

Keywords

Aneurysm, Abdominal Aorta, Endovascular, Complications, Stent Thrombosis

1. Introduction

For more than two decades the aortic stents have emerged as a therapeutic alternative to open surgery in the management of abdominal aortic aneurysms. Several studies have shown the benefits of endovascular treatment over conventional surgery [1]. This technological advance poses some problems in terms of complications, the monitoring of patients as well as the long-term outcome of these devices. The latest recommendations from the High Authority of Health (HAS) and the French Health Products Safety Agency (AFSSAP) have reinforced the important and growing role of these aortic stents [2]. At the beginning of this experiment, most of the complications resulting from the placement of these stents were related to the materials involved in their manufacture (1st generation). Since then, the pharmaceutical industry has constantly improved their devices with the appearance of new generations of stents (2nd generation), reducing a number of these complications [3]. Due to these new recommendations, the number of implantations of aortic stents is increasing exponentially.

The complications and outcome of these prostheses are still a major concern for practitioners even though most of them can be treated endovascularly. We report a case report of complete thrombosis of an ANACONDATM bifurcated stent (Anaconda AAA endovascular graft, Vascutek, Terumo, Renfrewshire, UK), an unusual complication of aortic stents in the department of thoracic and vascular surgery of the hospital center of Cholet. The purpose of this work was to understand the causes, mechanism, incidents or accidents that contributed to this complication in order to improve the management of these patients.

2. Case Presentation

Mr. D.J, 48 years old, is a poly-vascular patient with as cardiovascular risk factors, well-balanced hypertension, active smoking estimated at 30 PA, obesity (95 kg/165 cm/BMI = 34.8) and familial ischemic heart disease. He has a history of recent ischemic heart disease with a left ventricular ejection fraction (LVEF) at 35%, a moderate chronic obstructive pulmonary disease (COPD), a penicillin allergy with angioedema (Quincke edema) and a hostile abdomen.

During a pulmonary assessment, a non-symptomatic aneurysm of abdominal aorta under renal (AAA) with 56 mm of large diameter was found incidentally by ultrasonography, evolving at 8 mm/year of growth. An CT angiography (CTA) performed before surgery (**Figure 1**) was used to calculate the different measurements: anteroposterior diameter of the AAA (56.9 mm with thrombus and some parietal calcifications), sub-renal proximal neck (18 mm in diameter and 20 mm in length without calcification or circumferential thrombus), sub-renal proximal neck angulation at 30 degrees, small distal aortic neck at 18 mm with parietal calcification, primitive iliac with 13 mm at right and 10 mm at left, moderate tortuosity, small external iliac with 8 mm at right and 7 mm at left. Right iliac angulation was assessed at 40 degrees. The indication of the placement of an ANACONDA B21 bifurcated stent with two L10/100 legs (Anaconda AAA



Figure 1. CT-angiography before implantation in volume rendering (VRT).

endovascular graft, Vascutek, Terumo, Renfrewshire, UK) was selected. The intervention was accepted in principle and the informed consent of the patient obtained.

We proceeded to the implantation of the aortic stent near the scarpas and under general anesthesia 5 months later. The pose was easy and fast with a normal final angiographic control. But as we closed the scarpas, we found a weakening of the femoral pulse without obvious hemodynamic cause. It was decided to repeat and perform an angiogram which revealed a thrombosis of the two legs of the prosthesis despite the 7000 IU of heparin administrated in situ during the procedure. A clearing with the Fogarty catheter was carried out associated with a systematic balloon dilatation of the aortic bifurcation and the two legs. The final control was satisfactory with a good positioning of the endoprosthesis without thrombus, endoleak or stenosis of the legs.

The post-surgery outcome was simple except an inflammatory syndrome with a fever from day 2 which had finally regressed allowing the patient to leave the hospital on day 5.

An abdominal X-ray without preparation (ASP) was performed at the exit confirming the correct position of the endoprosthesis. We performed an ultrasound Doppler at day 8 post surgery who confirmed the stability of the aneurysmal bag, the permeability of the stent without endoleak or legs stenosis. ACT angiography (Figure 2) also performed on day 9 revealed a surprise, the presence of the parietal thrombus at the proximal neck that did not exist on the pre-surgery scan. Therefore, the proximal neck seems to evolve at posteriori 5 months before implantation of the endoprosthesis. Despite this finding, the endoprosthesis remained constrained at the proximal neck without significant



Figure 2. CT-angiography 9 days after implantation confirming the stability of the endoprosthesis.

migration or stenosis in the unobstructed legs.

At four months post-implantation, the X-ray (ASP 4 impacts) had highlighted a slight migration of 5 mm down from the upper end of the endoprosthesis with horizontalization of the proximal rings appearing less constrained. At six months post-implantation an ultrasound Doppler confirms the permeability of the endoprosthesis without endoleak or thrombus but especially a retraction of the aneurysmal bag of 4 mm. The migration of 5 mm was confirmed by a control CT angiography without endoleak. But note that the patient has returned to active smoking since day 15 post-surgery.

At 12 months post-implantation we find the same but stable X-ray findings. At the CT angiography scan (**Figure 3**), the migration of the upper extremity seems to be increased up to 10 mm compared to the lowest kidney and the parietal thrombus seems to extend until inter kidney without twist nor stenosis of the legs. There was no endoleak and the aneurysmal sac continued to be retracted. A total thrombosis of endoprosthesis with a bilateral acute ischemia had occurred in the 13th month post implantation in probably a context of anaphylactic shock after automedication with Augmentin (Amoxicillin + clavulanic acid) for a flu syndrome. The patient was known to have allergy to penicillin. An emergency unblocking with the Fogarty catheter was successfully performed in another center by Scarpa way. The post-surgery outcome was marked with acute kidney failure requiring temporary hemodialysis.

Nine days after this new surgical procedure, a CT angiography confirmed the



Figure 3. CT-angiography 12 months post implantation confirming migration without endoleak.

persistence of the migration at 10.4 mm with a proximal neck with stable diameter associated with a small thrombus in the legs, but without endoleak.

We finally decided in a multidisciplinary discussion the explantation of the stent followed by aortobi-iliac bypass with supra-renal clamping at the 15th month post-implantation. A thrombophilia assessment revealed moderate hyperhomocysteinemia. The patient was given an anticoagulation treatment due to the high thromboembolic risk. There were no post-surgery complications and the patient left the hospital after 10 days. The CT angiography performed at 6 months of follow-up was satisfactory. The patient filled well and had started his normal daily activities.

3. Comments

The complications of endovascular treatment of abdominal aortic aneurysms are well known. Thrombosis usually involves only one leg and its frequency varies from 0 to 5% according to the literature [4]. Several risk factors for leg thrombosis have been identified. For Cochenec *et al.* [5] young age, 1st generation prostheses, and leg plication were significant factors in thrombosis. Some authors believe that female sex, small diameter and tortuosity of the iliac arteries, and extension of the stent to the external iliac artery are predisposing factors for the occurrence of leg thrombosis [4] [6]. A narrow aortic bifurcation was considered as a high-risk situation of thrombosis [7]. In this case, in addition to the patient's young age (48 years), history and cardiovascular risk factors, anatomical features

of the aneurysm could be predisposing factors to a postoperative thrombotic complication. The diameter of the aortic bifurcation measured at 18 mm could be considered narrow. The common and external iliac arteries had small diameter with tortuosity and moderate calcification. The procedure of implantation of the bifurcated stent proceeded in a simple way with a good final angiographic result. Immediate thrombosis at the closure of the scarpas was unrelated to the stent since we found no area of residual stenosis or plication on fluoroscopy and arteriography. For the size of the iliac arteries, the 10 mm legs implanted were not considered with small diameter. We considered that it was probably related to the narrowness and calcification of the aortic bifurcation achieving compression or collapse at the origin of the legs but also to the quality of the circulating arterial flow, considering the alteration of the Left ventricular ejection function (LVEF) and bilateral thrombosis of the legs. Thrombo-embolectomy associated with balloon dilation of the aortic bifurcation and both legs successfully restored vascularization of the legs. In addition to leg occlusion, thromboembolic and access ways problems are considered as causes of ischemia after aortic stent implantation. For a better accommodation of the aortic stents, the diameter of the aortic bifurcation should be greater than 20 mm according to the recommendations of good practice [8]. However, for some authors, with the accumulated experience and a well codified technic, the implantation of bifurcated stent in a narrow aorta and iliac small diameter is safe and effective [9]. Although more common with first generation devices, thrombosis is not uncommon with new stents. Most of the studies on new-generation stent thrombosis are related to: Gore-Excluder (Gore & Associates, Flagstaff, Arizona), Talent and AneuRX (Medtronic, Santa Rosa, California), Zenith (Cook, Bloomington, Indiana) [1] [5] [7] [9]. Few studies have focused on the ANACONDATM brand [10]. It is accepted that most thrombotic events occur during the first year after implantation [5] [11]. The total thrombosis of the stent in this case has occurred beyond one year without any usual cause detected. The notion of restarting of smoking, cardiovascular status and anaphylactic shock secondary to penicillin allergy and the later discovery of moderate hyper-homocysteinemia may be considered as contributing factors to systemic thrombosis. Various therapeutic options ranging from endovascular treatment to surgery and even armed surveillance were described according to the general condition of the patient, his comorbidities, the clinical symptomatology and the observed lesions. Endovascular treatment remains the reference treatment for many authors [5] [11]. It is usually a fibrinolysis associated with the correction of underlying lesions by balloon angioplasty or stent addition. The surgical option is preferred in case of failure of endovascular treatment but also in cases of severe ischemia. It may be a surgical thrombectomy with a Fogartycatheter associated with either stenting or extra-anatomic femoro-femoral or axillo-femoral revascularization. Corrioco et al. [6] preferred an extra-anatomic revascularization than surgical thrombectomy which could disintegrate the stent with a risk of endoleak and enlargement of the aneurysm sac.

Moreover, to avoid the hemorrhagic risk like intracerebral or retro-peritoneal hematoma related to thrombolysis, some preferred conventional surgery. For Oshin, O.A. et al. [11] the systematic deployment of self-expanding iliac stents in patients with high anatomical risk could significantly reduce the risk of leg thrombosis. In our case, a surgical thrombectomy procedure was successfully performed. The migration of the stent detected existed before clearing. The influence of the morphological characteristics of the superior neck, the existence of dilatation after implantation and the inking systems of the endovascular devices have been incriminated in the occurrence of migration with consequences of endoleaks and enlargement of the sac requiring secondary re interventions, or rupture of the aneurysm [12]. The most likely explanation for stent migration would be a judgment error of the upper thrombus that appears to have changed before implantation. A new CT scan was needed to assess the progress of the aneurysm even though it is not required by the recommendations in this area. In addition, the proximal inking system of the Anaconda stent is infra-renal via hooks that will not fix well in case of thrombus. The migration had no consequence in terms of type I endoleak or an increase in the diameter of the aneurysm sac. Due to the persistent factors of high risk of thrombosis and the morbidity associated with the various secondary interventions, it was decided in multidisciplinary consultation to carry out the explantation of the stent. This intervention, although reputedly difficult, was successfully performed with the placement of an aorto-bifemoral Dacron prosthesis after total resection of the stent. In situation of such an anatomical difficulty, apart a bifurcated stent, the implantation of an aorto-iliac endoprosthesis followed by an extra anatomical cross femoral bridge seems a better alternative. Currently with advances in technology and experience accumulated by practitioners, endovascular treatment has no limit. The teaching of classical surgery seems to be declining in favor of the endovascular. There is a concern for this generation of surgeon called "all in endovascular" who will be confronted with the management of complications resulting from this treatment.

4. Conclusion

The long-term results of endovascular treatment of abdominal aortic aneurysms depend on compliance with anatomical criteria, manufacturers' recommendations and the technical expertise of practitioners. Improvement of our results requires better patient selection.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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