

Hybrid procedure in a patient with symptomatic thoraco-abdominal aneurysm and prior abdominal aortic reconstruction – case report

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Abstract

Open repair of thoracoabdominal aortic aneurysm is connected with high mortality and morbidity. On the other hand, endovascular treatment of thoraco-abdominal aneurysms, which started 10 years ago, reduced perioperative mortality and morbidity. However, it results in a high level of late complications. It seems that an interesting solution to the problem is a hybrid procedure, which allows late complications to be reduced with acceptable levels of operative mortality and morbidity. This case report presents the use of a hybrid procedure in treatment of symptomatic thoraco-abdominal aneurysm in a patient with prior abdominal aortic reconstruction. In the first stage the patient underwent open revascularization of visceral vessels of the aorta. One week later a thoraco-abdominal stent-graft was implanted. The perioperative and postoperative period was uncomplicated. Two months after the second intervention the patient returned to work. Control imaging conducted 30 and 90 days after the procedure confirmed patency of all revascularized vessels and did not reveal any graft-related complications. The hybrid procedure seems to be an interesting alternative for open and endovascular repair of thoraco-abdominal aneurysms because it combines the advantages of open and endovascular repair. It also gives an opportunity to perform the procedure within a reasonable period of time from diagnosis of symptomatic thoraco-abdominal aneurysm.

Key words: abdominal aortic aneurysm, endovascular aortic repair, thoraco-abdominal aneurysm, hybrid procedure, open aortic repair.

Introduction

Thoracoabdominal aortic aneurysms represent about 7% of all aortic aneurysms. They are much less common than are aneurysms of the abdominal aorta located below the renal arteries, but due to their location require careful planning of the surgical treatment. The common Crawford classification is used to categorize thoracoabdominal aneurysms with regard to the extent of aortic and branch involvement. Large and symptomatic thoracoab-

dominal aneurysms require surgical repair because of the possibility of rupture. The risk of rupture for an aneurysm with the diameter of 5 cm is 1% per year, with the diameter of 6 cm it is 10.2%, and with the diameter of 7 cm it exceeds 32.5%. The rupture of thoracoabdominal aortic aneurysms is fatal in most cases. Two techniques of aneurysm management prevail: classic open repair and endovascular treatment. A hybrid procedure has been gaining in popularity for some time now [1, 2].

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Case report

In December 2010, a 53-year-old patient was admitted to the Department of General and Vascular Surgery and Angiology with epigastric pain radiating to the back.

The patient had been treated due to arterial hypertension and ischaemic heart disease. In 2006 the patient was operated on because of abdominal aortic aneurysm located below the renal arteries. A straight aorto-aortic prosthesis was implanted during the procedure. Angio-CT performed revealed class 3 thoracoabdominal aortic aneurysm according to the Crawford classification (Figure 1). The aneurysm began in the thoracic aorta at the level of the 6th vertebra and extended to the aorto-aortic prosthesis implanted earlier. It involved the origin of the coeliac trunk, superior mesenteric artery and renal arteries. The maximum transverse size of the aneurysm was 9.6 cm × 8.7 cm (Figure 2). In the first stage blood pressure was decreased to the maximum value of 110/70 mmHg with nitroglycerine infusion and hypotensive drugs oral therapy. The ailments were reduced, but they did not resolve completely. Given the symptomatic character of the aneurysm and its size, the patient required urgent surgical treatment. It was decided to use the hybrid technique (Figure 3).

Firstly, the patient underwent open revascularization of visceral vessels of aorta. A bifurcated, silver

prosthesis was attached to the previously implanted prosthesis. The right renal artery was anastomosed to the right branch of the prosthesis in an end-to-side manner and the further portion of the right prosthesis branch was attached to the coeliac trunk with end-to-end anastomoses. The left branch of the prosthesis was attached to the left renal artery using end-to-end anastomosis. Additionally, another straight prosthesis was anastomosed to the left branch. It was also connected to the superior mesenteric artery in an end-to-side manner (Figure 4). The procedure lasted for 3.5 h. Blood loss amounted to 1500 ml. Vascular anastomoses with renal arteries were technically the most challenging due to arterial fragility and deep location. Postoperative course was uncomplicated. In the 2nd stage, 7 days following the open repair, an aortic stent-graft was implanted (Valiant Captiva, Medtronic). The left common femoral artery was dissected and the right common femoral artery was punctured percutaneously under local anaesthesia. The catheter was placed through the puncture for arteriography. The stent-graft was inserted via the incised femoral artery, and consisted of two elements due to the length of the managed aneurysm. The first part was anchored in the proximal, healthy portion of the aorta, the second was connected with the first one and finished in the aorto-aortic prosthesis, just above the silver prosthesis implanted for visceral vessels of the aorta (Figure 5). The length of the proce-

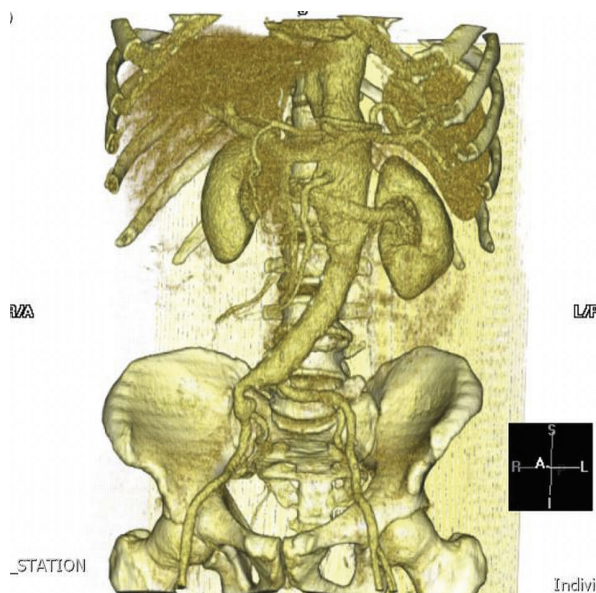


Figure 1. 3D reconstruction of the thoraco-abdominal aneurysm (angio-CT)

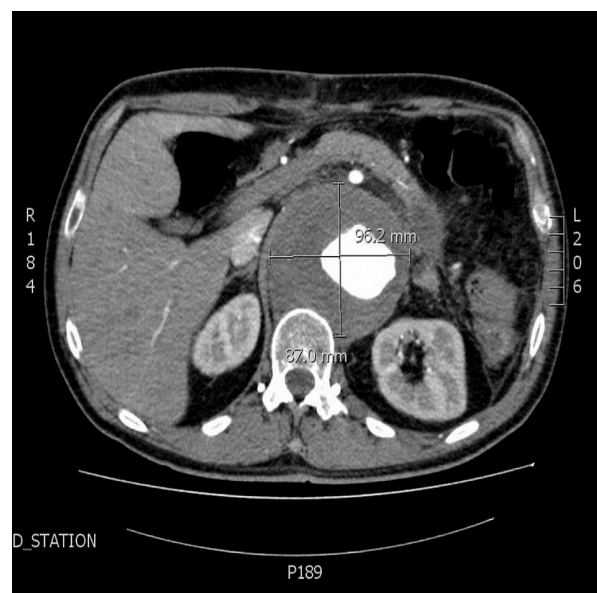


Figure 2. The maximum transverse size the aneurysm reached at the L1 level (angio-CT)

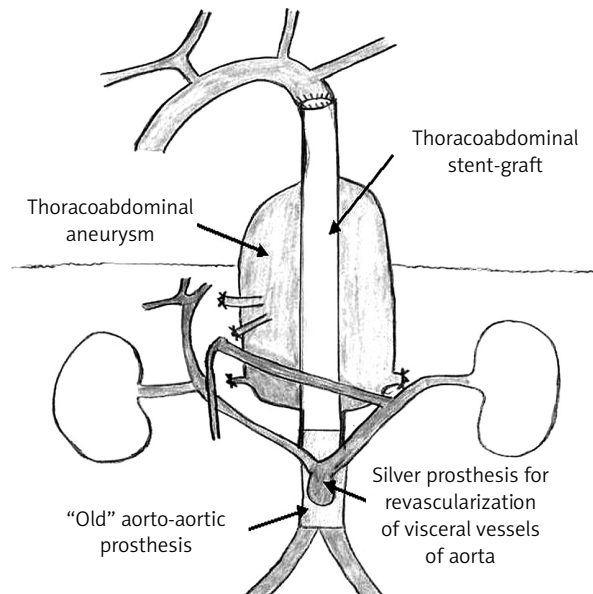


Figure 3. Plan of the hybrid procedure

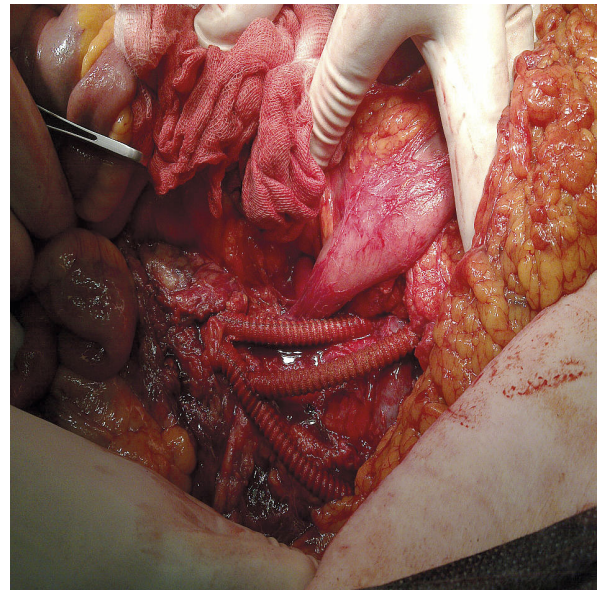


Figure 4. Intraoperative image of the first stage of the surgery. Implanted silver vascular prosthesis used for revascularization of the visceral branches visible in the operative field

cedure was 1.5 h. Blood loss amounted to 300 ml. The peri- and post-operative course was uncomplicated. The patient was released from the hospital on the 3rd post-operative day. After 30 days, follow-up angio-CT was performed and after 3 months angio-NMR of the

thoracoabdominal aorta. Both examinations proved total exclusion of the aneurysm from circulation. Both of them showed full patency of anastomoses with the visceral vessels (Figure 6). Two months after the procedure the patient returned to work.

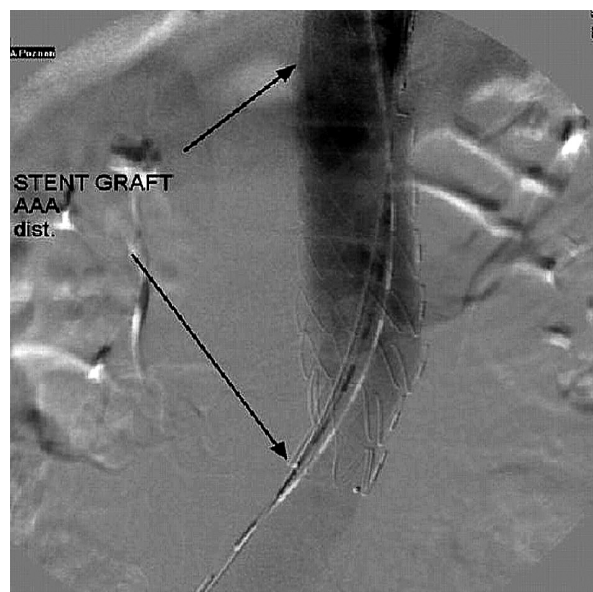


Figure 5. Endovascular implantation of the aortic stent-graft

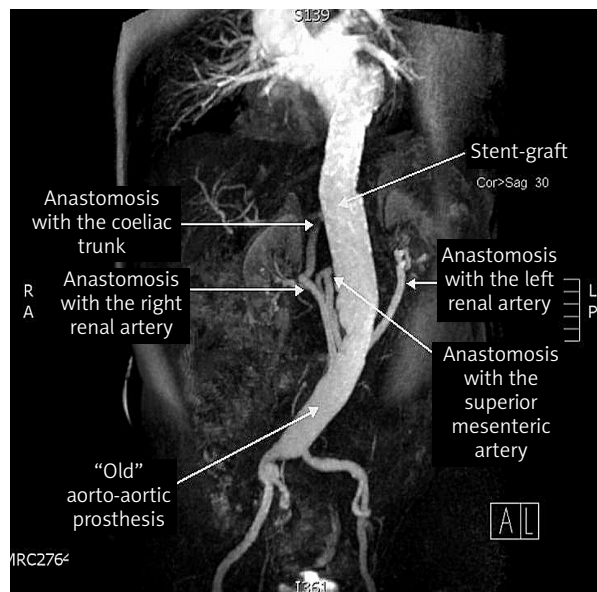


Figure 6. Vascular reconstruction performed 3 months after the surgery (angio-NMR)

Discussion

Open management of thoracoabdominal aortic aneurysm is the oldest method of treatment. The first repair of the thoracoabdominal aortic aneurysm was performed by DeBakey using a homograft, and Crawford improved treatment with vascular prostheses. This technique was and is widely employed [3, 4]. However, it requires a specialized vascular centre with experience in the management of the pathology of such type.

In many cases these procedures are connected with the necessity of extracorporeal circulation as performing a few anastomoses exceeds 20-30 min, the final time for visceral vessels closure. The highest mortality rate is observed in the peri- and post-operative period (up to 30 days following the procedure). It is estimated at around 8-25%, the risk of spinal cord damage at 3-12% and renal failure at 5-18% [5-9].

Other significant complications include cardiovascular incidents and respiratory failure. Complications connected with the performed anastomoses are rare and do not exceed 1-3%. Good long-term results are an undisputable advantage of the technique and complications connected with the implanted prosthesis are rare. Before stent-grafts were introduced, the technique was the only solution to treat thoracoabdominal aortic aneurysms [10-12]. Endovascular techniques opened new opportunities for thoracoabdominal aneurysm management. In 1991 Parodi described the first use of a stent-graft to treat abdominal aortic aneurysm. Dak *et al.*, on the other hand, used a stent-graft to manage thoracic aneurysm [13]. Since then, the endovascular technique has gained huge popularity. With the experience and the development of equipment, the method, initially used only for management of abdominal aortic aneurysms located below renal arteries and thoracic aneurysms, has begun to be used for thoracoabdominal aortic aneurysms. Mostly branched and sometimes fenestrated stent-grafts and chimney technique have been used for those cases. It is necessary to remember, however, that the rigorous classification of patients is the key to successful endoluminal treatment. The size of an aneurysm and its neck region, concurrent arteriosclerosis obliterans and the relationship with the surrounding organs are the most significant factors determining the possibility of the procedure. Due to

strict criteria, only 40-60% of patients qualify for endovascular treatment. Disregarding the criteria dramatically increases the risk of complications [14-16]. The main postulated advantage of the endovascular technique is the reduction of mortality and peri- and postoperative complication rate. The mortality rate is estimated at 7-15%, spinal cord damage at 1-12%, renal failure at 4-12% [17]. The cost of the procedure and the long time required to prepare a stent-graft (it is made on request) are the most crucial disadvantages of the method. Additionally, long-term complications connected with a stent-graft are a major issue. Endoleaks, stent-graft migration and thrombosis in one of its branches are among the main long-term complications. Due to the lack of large series of patients, unequivocal data concerning the number of complications are unavailable. Published single series report the necessity of a secondary intervention in 20% of cases within a year. However, the available data from randomized trials concerning the number of long-term complications in cases of stent-graft implantation in classic abdominal aortic aneurysms located below the renal arteries shows that they amount to 20-44% in an 8-year observation period, which allows for the assumption that the number of these complications in cases of much more complex thoracoabdominal stent-grafts may be even higher [18]. In the present case, the authors decided to combine the advantages of the classic surgical procedure and endovascular treatment, avoiding some of the disadvantages of both presented methods by using the hybrid technique. For some time it has been very popular and in selected cases it produces better results than the previously described techniques. Unfortunately, there are no randomized trials on hybrid techniques in thoracoabdominal aneurysm treatment [19, 20]. The open repair itself appeared to be risky due to the patient's heavy overloads and the extent of the procedure. On the other hand, the endovascular technique was unacceptable due to the urgency of the procedure, no time for stent-graft preparation and the risk of numerous long-term complications connected with the stent-graft implantation. The hybrid procedure did not require extracorporeal circulation and the closure of the aorta. It is also worth mentioning that the time of the visceral vessels' closure is short as each of the endovascularized arteries is closed separately when anastomoses are performed. Additionally, both stages of the procedure can take place at an interval

of a few days, which allows the patient to be stabilized if necessary. It also appears that the hybrid technique may be especially useful for class 3, according to the Crawford classification of thoracoabdominal aneurysms, as it reduces the extent of the open surgery, limiting it to opening only one body cavity – the peritoneal cavity. All these factors decrease the risk of perioperative complications [4, 19, 21, 22]. Anastomoses performed in the area of healthy visceral arteries are another big advantage of the method. In the case of open repair, the Carrel's patch anastomosis frequently uses the aneurysmal artery; in other words, it utilizes the defective arterial wall. The shortness of the procedure, contrary to an endovascular method, as preparation of a stent-graft is time-consuming, in the case of a symptomatic thoracoabdominal aneurysm, is another significant factor supporting the hybrid technique.

Conclusions

Uncomplicated peri- and post-operative period, and the performed follow-up examinations, which did not reveal any complications connected to the implanted stent-graft and coeliac vessel prostheses, enable us to assume that the chosen method was the right one. It appears that a hybrid technique is an interesting alternative for thoracoabdominal aneurysm management due to the combined advantages of open and endovascular treatment and the shortness of the procedure.

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