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Early abdominal aortic rupture after Nellix endovascular aneurysm sealing

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Abstract

This case concerns a 73 year-old woman, that suffered from symptomatic aortic abdominal aneurysm. Due to the complex anatomy of the aneurysm she was treated with nellix endovascular aneurysm seal device. The implantation was successful, and the completion angiography showed no endoleak. On the 9th day after the procedure, the patient presented severe abdominal pain with peritoneal symptoms, significant anemia and hypovolemic shock. The patient was subject to emergency laparotomy. The aortic rupture was identified. The Nellix device was removed and replaced with bifurcated silver-covered PTFE graft.

Key words: Nellix, EVAS, EVAR, aortic rupture, endovascular procedures

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Introduction

In recent years numerous new technologies were introduced in aortic abdominal aneurysm (AAA) treatment. One of them is the nellix device for endovascular aneurysm seal (EVAS). According to the manufacturer the system „is the next generation in AAA therapy, intended to treat more anatomies than currently approved endovascular stent graft devices". In an initial clinical trial involving 34 patients, 100% implant success was observed. After two year follow-up, no aneurysm rupture, conversion to open surgery or stent graft migration was observed [1].

Case presentation

73 year-old woman has been admitted to the hospital due to severe abdominal pain, with a history of AAA diagnosed few months prior to the event. The comorbidities were hypertension and hypothyroidism. The CT angiography revealed a rapid diameter growth from 46mm to 53mm in 3 months, an intraluminal clot and a minor dissection on the atherosclerotic plaque.

The anatomy of the aneurysm was complex. Each of the kidneys was supplied by two renal arteries. In both cases the lower renal arteries were dominant. The left lower renal artery originated from the aneurysm (Fig. 1). The right lower renal artery originated just a few millimeters above the aneurysm (Fig. 2), the aortic diameter at that level was 26 mm. In addition, the aorta above was "Z" shape angulated (Fig. 1). Both iliac arteries were patent. The left iliac artery was over 90* angulated (Fig. 1).

Considering the potential benefits of Nellix EVAS and its broad applicability, it was the only endovascular option for the patient to save at least one kidney (by sealing only 1 of 4 renal arteries). Other devices would not be suitable due to a very short and angulated neck, although we can hardly identify the neck at all in this case.

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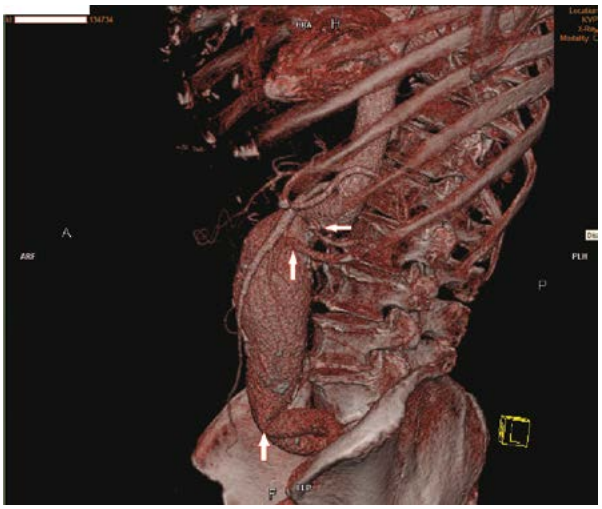

Figure 1. Left renal arteries, left iliac artery

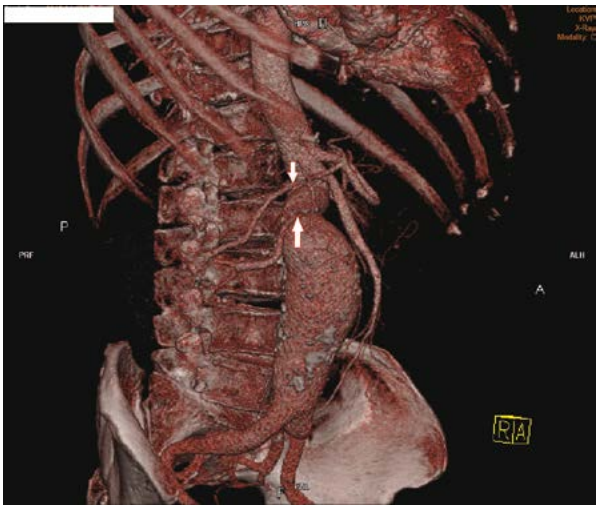

Figure 2. Right renal arteries

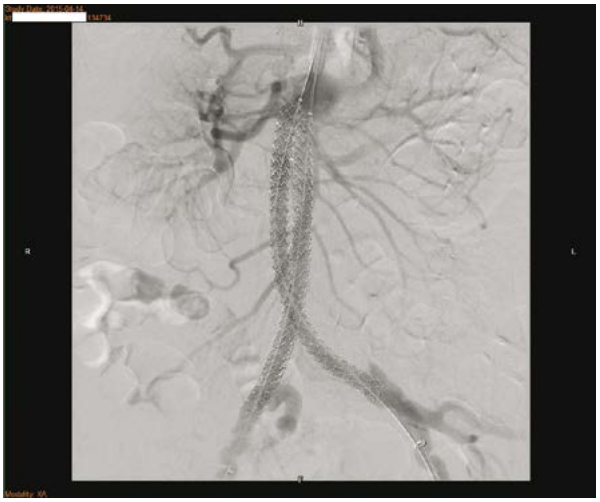

Figure 3. Completion angiography

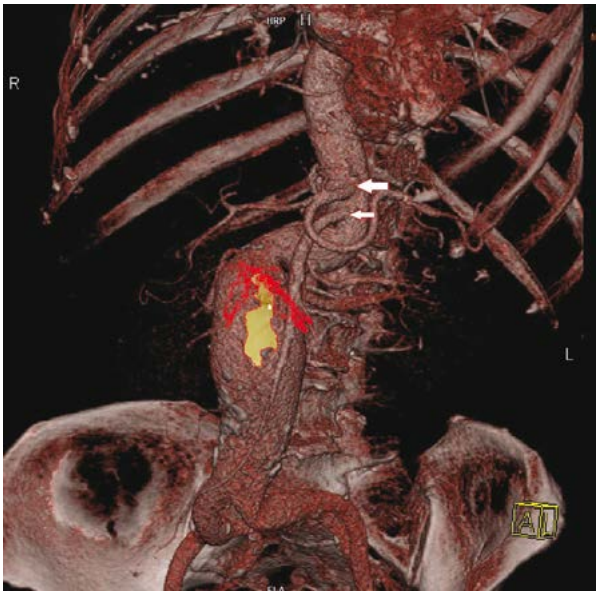

Figure 4. Draft of the rupture

Two 10 mm × 160 mm Nellix stents were positioned from just below the lower right renal artery into the common iliac arteries. The attached endobags were prefilled with saline and then filled with liquid polymer under pressure monitoring.

The procedure was successful and the completion angiography showed EVAS with no endoleak (Fig. 3). The right lower renal artery was not sealed and the right kidney circulation was normal. The left lower renal artery was closed, as intended. Circulation in the left kidney was impaired.

In the first few days after the procedure the patient presented increasing abdominal pain. On the 4th day the ultrasound revealed left retroperitoneal hematoma, blood test showed minor anemia. The patient was re-operated. The on call surgeon suspected the bleeding originating from left femoral artery communicating with the retroperitoneal space under the inguinal ligament. Revision of left femoral artery revealed no bleeding, the retroperitoneal space was opened, and the hematoma evacuated. Minor bleeding from the left common iliac artery was identified, located just at the end of the left stent, where the artery angulated. No aortic rupture was identified. For another few days the patient remained asymptomatic and seemed to be recovering well.

On the 9th day, the patient presented severe abdominal pain with peritoneal symptoms, significant anemia and hypovolemic shock. The patient was subject to emergency laparotomy. A large retroperitoneal hematoma was identified. After removing it, a large rupture on the anterolateral aortic wall with severe bleeding was found. The rupture was approximately

Figure 5. Nellix stents after explantation

4 cm long and up to 2 cm wide (Fig. 4), it was mostly covered with the polymer-filled endobag. The bleeding originated from the proximal part of the rupture. The graft was removed and replaced with bifurcated silver-covered PTFE graft.

In the examination of the removed Nellix none of the elements appeared to be damaged. Endobags were not torn, the polymer was firm (Fig. 5).

On the following days the patient was managed in ICU, due to Multiple Organ Dysfunction Syndrome (renal failure, intestinal necrosis, heart failure). The patient was subject to 3 subsequent laparotomies due to intestinal ischemia and necrosis. Eventually the patient died on the 29th day after the surgery.

Discussion

Nellix EVAS is not a 100% successful AAA repair method. The EVAS FORWARD study revealed freedom from reintervention on the 12th month was 98% when used inside the IFU (instructions for use), compared to 86% if outside the IFU (as in this case). The presented case brings more questions than answers. No endoleak was identified in completion angiography. This suggests that the implant migrated soon after the procedure. We cannot tell if the rupture was the result of an early endoleak or the aortic wall was damaged by the system itself during the procedure. We do not know exactly how the polymer filled endobag interacts with the aortic wall and what happens to the calcified lesions. Can they damage the aortic wall? We do not know what happens with the intraluminal clot. Can the pressure monitor fail during the procedure? Biophysical mechanics in atherosclerotic and dilated aortic wall is very complex. Expanding EVAS system inside aortic lumen must somehow change the forces that interact the aortic wall. As the goal of every endovascular AAA procedure is to reduce the pressure on aneurysm wall, during EVAS operation there may be some temporary increase of the tension during endobag inflation. The pressure monitor provided with Nellix is installed to the catheter on the external part of the system, which is quite far away from the sack itself. Considering elasticity of the catheter, the measurements may be inaccurate.

Conclusions

Endovascular treatment of AAA will always be a complex process, apart from the procedure itself, the most important step is precise qualification and optimal device selection. Nellix is the most contrasting system, as it is the only one that seals the entire aneurysm sack. That is why, EVAS still seems a promising method for adverse anatomy aneurysms, but we must consider a possibility of complications, when choosing best treatment option for the patient. More study on mechanical interaction of the system with aortic wall seems necessary.

Conflict of interest

None.

References:

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