CASE PRESENTATION

EVAR limb thrombosis, solved through rotational thrombectomy and conventional percutaneous angioplasty

Elvis Gabriel Botu¹, Horia Traila¹, Catalin Ușurelu¹, Marin Postu², Dirk Dreyer³

Abstract: Introduction – The abdominal aortic aneurysm (AAA) represents an irreversible dilation of the abdominal aorta. By comparison with classic surgery, abdominal aorta endovascular repair procedures (EVAR) have numerous advantages: reduced morbidity and mortality reduced procedural and hemorrhagic risk, rapid recovery. The partial or total endograft occlusion is one of the more common EVAR complications, with the occlusion being in most cases thrombotic, with the maximum incidence in the first three month after endograft insertion. Case presentation – We report the case of a 72 year old male patient, with multiple cardiovascular risk factors (cigarette smoking history, hypertension, dyslipidemia), coronary artery disease with angioplasty performed on the right coronary artery and diagnosed with partially thrombosed abdominal aortic aneurysm, extending to both common iliac arteries, for which an endovascular aneurysm repair was performed, with a bifurcated aorto-iliac supported endograft. Two month after the procedure, the patient reports to our center accusing intermittent buttock claudication on short walking distance and is diagnosed partial thrombosis of the endograft. An endovascular desobstruction approach of the endograft was decided, the repermeabilisation procedure being realized by a multidisciplinary team and consisted in rotational thrombectomy, followed by endograft remodeling with balloons and bare self-expanding and balloon expandable stents. Conclusion – the presented case highlights the importance of thrombotic load reduction prior to the conventional percutaneous angioplasty. The thrombectomy with the Rotarex® device obtained the recanalization of the endograft through extraction of the thrombotic material, allowing the bare stent angioplasty with a minimum risk of acute ischemia secondary to a possible distal embolization.

Keywords: abdominal aortic aneurysm, thrombosis, rotational thrombectomy, percutaneous angioplasty, AAA, EVAR.

Rezumat: Introducere – Anevrismul de aorta abdominală (AAA) reprezinta o dilatare irreversible a aortei abdominale. Prin comparație cu chirurgia clasică, procedurile de reparare endovasculară a anevrismelor de aorta abdominală (EVAR) au numeroase avantaje: morbi-mortalitate scăzută, risc operator mai mic, risc hemoragic redus, recuperare rapidă. Ocluzia parțială sau totală de endoprotesă este una dintre complicațiile cele mai frecvente ale EVAR, natura ocluziei fiind de regula trombotică, cu incidența maximă în primele trei luni de la montarea endoprotesei. Prezentarea cazului – Raportăm cazul unui pacient în vârstă de 72 ani cu factori de risc cardio-vasculari multipli (fost fumător, hipertensiv, dislipidemic), coronarian cu angioplastie la nivelul coronarului drept și diagnosticat cu anevrism de aorta abdominală parțial trombozat, cu extensie la nivelul arterelor iliac comune bilateral, pentru care s-a efectuat protezarea endovasculară cu stent graft aorto-iliac bilateral. La doua luni postprocedural pacientul se prezinta in centrul nostru pentru claudicatie intermitenta inalta la distanta mică de mers și este diagnosticat cu tromboză parțială a endoprotesei. S-a decis dezobstrucția endovasculară a protezei, procedura de repermeabilizare fiind realizată în cadrul unei echipe pluridisciplinare și constând în trombectomie rotațională, urmată de remodelare ulterioră a endoprotesei cu balon și implantare de stenturi atât autoexpandabile cât și pe balon. Concluzii – Kazul de față subliniază importanța reducerii încărcăturii trombotice înaintea angioplastiei percutane convenționale. Trombectomia cu dispozitivul Rotarex® a permis recanalizarea endoprotesei prin îndepărterea materialului trombotic pentru a permite angioplastia cu stenturi cu risc minim de ischemie acută secundară embolizării distale. Cuvinte cheie: anevrism de aorta abdominală, tromboză, trombectomie rotațională, angioplastie percutană, AAA, EVAR.
INTRODUCTION
The abdominal aortic aneurysm (AAA) represents an irreversible dilation of the abdominal aorta. There are a number of factors associated with the apparition and evolution of AAA – advanced age, male, smoking, hypertension and a history of atherosclerotic disease. The association between smoking and AAA deserves a special mention, as over 90% of the patients with AAA are smokers or ex-smokers. AAA is, from an epidemiologic standpoint, only second after pulmonary cancer in terms of the correlation with smoking, having a stronger statistical association than with the cerebrovascular or coronaries disease.

By comparison with classic surgery, abdominal aorta endovascular repair procedures (EVAR) have numerous advantages: reduced morbidity and mortality reduced procedural and hemorrhagic risk, speedy recovery. EVAR have a mortality risk estimated at 1.4% compared to 4.2% for open surgery (OR 0.3; 95% CI 0.22-0.50; P < 0.0001). EVAR procedures are associated with up to a 3 fold reduction of per operative mortality compared with patients with similar characteristics who have undergone an elective AAA surgical repair, which checks out even for younger patients with fewer comorbidities.

Still, EVAR is not a simple or risk free procedure; numerous periprocedural complications can occur – aortic rupture, endo-leaks, endo-graft migration, endo-graft limb occlusion, high re-intervention rates. The occlusion of one of endo-grafts' limbs or one of the extensions is one of the more frequent complications, being determined by either anatomical factors, or particularities of graft implantation (endoprostheses size and type, implantation technique, etc.), or a combination of those. The incidence of endoprostheses occlusion is estimated between 2 and 25%, and the nature of occlusion is usually thrombotic, with the maximum incidence for occurrence in the first two month after the implantation of the endograft.

The anatomical factors are more often implicated in graft occlusion. They are represented by: small caliber arteries (especially in women), excessive aneurysm neck angulation (over 60°), tortuous iliac arteries, iliac artery dissection, a small caliber and calcified distal aorta.

The treatment of endograft occlusion can be: endovascular, surgical (femoro-femoral, aorto-femoral bypass), hybrid or conservatory. There is controversy regarding the optimal therapeutic attitude, which is why prevention of graft occlusion is of major importance – patient selection, based on a favorable anatomy, proper graft type and size selection and continuous platelet antiagregant therapy for 12 month are prophylactic recommended measures.

CASE PRESENTATION
We report the case of a 72 year old male patient, with multiple cardiovascular risk factors (cigarette smoking history, hypertension, dyslipidaemia), who reports to our center accusing intermittent buttock claudication on short walking distance. The patient was known with coronary artery disease for which angioplasty with DES was performed on the right coronary artery, one year prior to the current presentation. Later, the patient was diagnosed with partially thrombosed abdominal aortic aneurysm, extending to both common iliac arteries, asymptomatic, but considered to have indication for intervention (Figure 1).

Given the heighten surgical risk, but mainly the patients' preference, a decision was taken for endovascular repair with the mounting of an aorto-biiliac stent graft, procedure performed in another clinic. Pre-procedural, the difficulty posed by the anatomic particu-
Elvis Gabriel Botu et al.
EVAR limb thrombosis

Aneurysm anatomical peculiarities of the case was acknowledged (aneurysm neck angulation, kinking and bilateral calcifications of the iliac arteries, aortic proximal angle of 120°), with high risk peri-procedural complications and possibly graft limb occlusion. An E-Tegra® system (Jotec Gbmh) stent graft was implanted, with bilateral iliac extensions, of 19 mm proximal and 15 mm distal diameters. The main body prosthesis was deployed through right femoral abdomen. The control injection after stent graft implantation showed a type I endoleak proximally, solved through balloon post dilatation.

Two month after the EVAR procedure, the patient becomes symptomatic with intermittent high claudication (pain in the right buttock) with low threshold/on short distance (under 50 m) and lack of the pulse at the right femoral artery. With the history of recent aortic stent grafting (2 month prior the current presentation), the suspicion of EVAR complication was raised, with the location of the pain suggesting a distal critical lesion or occlusion of the vascular endoprosthesis.

An angio CT of the abdominal aorta and iliac arteries showed a thrombosed aneurismal sac, with no endoleak, the thrombosis of the prosthesis’ right limb and of the extension attached to it (Figure 2, 3 and 4). At the level of the right limb prosthesis, the axial image shows what appears to be the intraluminal folding of the metal struts of the stent grafts’ limb inside the right common iliac artery (Figure 5). It also shows important under expanding and significant stenosis at the level of the left stent grafts’ limb extension. (Figure 3).

The diagnostic was completed through angiographic exploration of the abdominal aorta and iliac arteries, which confirmed the angio CT diagnostic, showing the occlusion of the right limb of the stent graft and the extension attached to it (Figure 6). Refill through collaterals from the left internal iliac artery, with slow flow and delayed filling of the arteries of the inferior right limb (Figure 6). The angiographic aspect is suggestive for intraprosthetic thrombosis, at the same time showing a tight stenosis of the left limb extension of the stent graft, secondary to a significant under-expanding of the endoprosthesis at this level, in a kink bend (Figure 6).

We considered as possible causes for endoprosthesis occlusion the presence of sever iliac arteries kinking, associated with a possible oversizing of the stent graft during the procedure and inadequate apposition of the prosthesis to the vessel walls, causing se-
With those considerations in mind, we decided to still approach the case percutaneously, but securing the procedure by the use of a device realizing mechanical thrombectomy with simultaneously thrombaspiration, followed by bare stents angioplasty of the remaining subjacent lesions. Taking into account the time elapsed from the first intervention till occurrence of present symptoms, we considered the thrombus being sufficiently organized so it wouldn’t be suitable for thrombaspiration with a Penumbra® (Penumbra Inc, USA) type device. On the other hand, a hybrid thrombectomy with Fogarty balloon would have carried a high risk of stentgraft dislodgement. All those considered, we opted for a strategy of initially using a rotational thrombectomy device from Rotarex® (Straubmedical Inc./CHE), considered the elective device for older thrombotic occlusions, completed with conventional angioplasty.

We performed a right brachial aboard with a 5F sheath, and bilateral femoral aboard: 6F sheath on the left and 8F on the right side, later changed to an 8F left, respectively 10F right, the latter necessary for the introduction of the 10F Rotarex® thrombectomy catheter. The arterial puncture of the right femoral artery was performed under anatomic and fluoroscopic guidance.
EVAR limb thrombosis

wire (Figure 7). Using a snare type recovery device introduced through the left femoral sheath we successfully extracted the broken guide wire from the descending aorta.

We decided to continue the thrombectomy procedure using a new guide wire placed in the abdominal aorta, after a predilation with a Chronus Advanced 4/80 mm Rontis® (Rontis Medical) balloon in the area of maximum stenosis where the guide wire fracture was recorded, in order to reduce the risk of repeating the incident and to allow an easier access for the thrombectomy catheter through that area (Figure 8). Subsequently we succeeded the passage with the thrombectomy catheter and we obtained recanalization of the vascular axis from the level of the right iliac artery up to the abdominal aorta, through the endograft, extracting a lot of thrombus (Figure 9).

We continued intervention with 8/60 mm Chronus Advanced Rontis® balloon dilatation, along the right limb and extension of the endoprosthesis and we implanted proximally inside the prosthesis right limb, a self-expandable stent Zeus® (Rontis Medical) 11/60 mm (Figure 10). Further on, we used the kissing stents technique with two balloon expandable Dynamic® (Biotronik) stents of 10/56 mm in the right limb and 10/25 mm in the left extension (Figure 11). We finally implanted another self-expandable 10/60 mm stent Protege EV3® (Medtronic) at the level of the distal right external iliac artery, forced by a flow li-
mitting dissection area, secondary the insertion of the 10F sheath in the extremely tortuous right iliac artery (Figure 12). The final angiographic result, was considered excellent at the end of the procedure, without any flow limiting areas of stenosis and with excellent distal blood flow (Figure 13).

At the end of the procedure, the left femoral puncture sites was closed with an Angioseal® (Terumo Europe NV) 8F arterial closing device and through surgical suture on the right side.

The patient’s ulterior evolution was very good, with mobilization from the next day following the procedure. The pulse was present on palpation both at right common femoral artery and right popliteal artery levels. On day 3 after the procedure, the patient was evaluated with Doppler ultrasound with the presence of triphasic flow of normal amplitude at femuro-popliteal, peroneal and posterior tibial levels. Patient was
The treatment for this type of complication has been amply described in the literature and includes a various array of procedures: surgical thrombectomy with Fogarty balloon, hybrid procedures (Fogarty thrombectomy followed by angioplasty), trombolysis followed or not by stenting, percutaneous thrombectomy associated or not with thrombosis and followed by stenting, primary angioplasty with stent or open surgical revascularization with anatomic by-pass (aorto-femoral) or extra-anatomic (femoro-femoral or axilo-femoral). For the time being there are no randomized studies evaluating the efficiency of angioplasty in the treatment of endograft occlusion.

Each one of the above techniques are caring procedural risks. Surgical revascularization techniques through by-pass are usually associated by high mortality. In the case of surgical thrombectomy, the difficulties are tied to the need of surgical access and the risk of modification of the prosthesis architecture, dislodgement or endoleaks following the passage of the Fogarty catheter. On the other hand the thrombectomy alone isn’t enough as it doesn’t correct the cause that lead to thrombosis. Thrombolysis – a similar approach as repermeabilisation through surgical thrombectomy – is encumbered by the hemorrhagic risk, while also leaving uncorrected an underlying mechanical cause.

Even though through conventional percutaneous angioplasty a vessel repermeabilization is obtained while also correcting the local cause for thrombosis (un-
derexpanded stent/disection/ residual stenosis), the risk of distal embolization of the thrombotic material in case of heavy thrombotic load is very high. Thus, an approach which combines a „debulking” technique reducing the thrombotic load, with one which corrects the endoprosthesys defect through endovascular remodeling seems to be the optimal approach.

Literature data are reporting as successful, even though quite rare, the of the Rotarex® device in the treatment of sub-acute or older thrombosis in native vessels or intraprosthetic. The device is composed of a rotational trombectomy system functioning at rotational speeds of 40,000-60,000 rpm coupled electromagnetically to the catheter and associated with a continuous aspiration system, which is triturating and extracting the thrombotic material, without risk of distal embolization. The contraindications of using such system, are severe calcifications, small caliber vessels, subintimal passage of guide wire, the impossibility of crossing the occlusion or severe vascular spasm.

CONCLUSIONS
We report the case of a aorto-biiliac endoprosthesys desobstruction, by using a strict endovascular approach, which combined the rotational thrombectomy and conventional angioplasty, with excellent immediate result. We can thus conclude that the interventional treatment with rotational thrombectomy and continuous aspiration followed by stent angioplasty represents a viable solution in the case aorto-iliac endograft occlusions, with good initial results, reduced procedural risks and high comfort for the patient. More studies, on a bigger number of patients with long-term follow-up are necessary in order to adequately evaluate the procedural efficiency, the frequency and the type of possible complications.

Disclosures: Dirk Dreyer is Director Global Sales & Marketing, and Member of the Executive Board Straub Medical AG Switzerland

References
4. Fabio Augusto Cypreste Oliveira1, Fabio Lemos Campe de1,1, Carlos Eduardo de Sousa Amorell,1, José Eduardo da Costa Filho2, Dani el Resende Gibbon2, Juliana Caetano Barreto3, Philippe Moreira da Silva, Endovascular treatment of iliac limb occlusion of a bifurcated abdominal aortic stent graft – rotational and aspiration thrombec-tomy followed by primary angioplasty and stenting, J Vasc Bras 2012, Vol. 11, No. 3
15. Pasqualino Sirignano – “Preoperative Intrascn Thrombus Load Predicts Worse Outcome after Elective Endovascular Repair of Abdominal Aortic Aneurysms” DOI: 10.1016/j.jvir.2015.07.005