CASE REPORT

Experience with a Fenestrated Stent Graft. A Case Report

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Received: 05/13/2010
Accepted: 07/20/2010

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SUMMARY

In patients with juxtarenal abdominal aortic aneurysm, the normal segment of infrarenal aorta necessary to obtain the proximal anchoring endograft is insufficient or lacking, for what with traditional endografts, there is no possibility of sealing or excluding the aneurysm. For this reason, in recent years, endografts with fenestrations (orifices) have been used for the preservation of visceral and renal branches as a valid and less invasive therapeutic alternative.
In this presentation we describe the first case of a juxtarenal aortic aneurysm treated in our country by placing an endograft with multiple fenestrations. This is a high surgical risk patient due to clinical comorbidities, to whom under regional anesthesia was placed an endograft with fenestrations to preserve the blood flow to the celiac trunk, superior mesenteric artery and both renal arteries. The procedure was successful with complete exclusion of the aneurysm. The first postoperative control showed exclusion of aneurysm with adequate patency of the visceral branches.

Rev Argent Cardiol 2011;79:55-58

Key words > Abdominal Aortic Aneurysm - Vascular Prosthesis

BACKGROUND

Endoluminal treatment of abdominal aortic aneurysms has been a significant change in the indications and the evolution of patients with an aneurysm, especially in the high risk ones for conventional surgery. Over the years, technical improvement was accompanied by advancements in endovascular devices and technological development in radiology with the support of high definition images have made this approach a more safe and effective procedure, not only short-term , but in the long term too.

However, the anatomical characteristics of the patients remain the main technical limitation. It is necessary a normal segment of infrarenal aorta to achieve a proximal anchoring of an endograft. But in patients with juxtarenal abdominal aortic aneurysm, in which this space is insufficient or non-existent, traditional endorafts are not able to seal or to exclude the aneurysm. For this reason, in recent years, endografts with fenestrations (orifices) have been used for the preservation of visceral and renal branches as a valid and less invasive alternative in conjunction with conventional treatment. These fenestrations are built in the basis of anatomical information obtained from tomographic images of high quality, which allow bespoke endografts.

This presentation describes a case that shows the technical feasibility of our environment to treat a juxtarenal abdominal aortic aneurysm with an endograft with multiple fenestrations, which was used in Argentina for first time.

CASE REPORT

Patient of 74 years, male, with a history of hypertension, smoking, obesity, chronic obstructive pulmonary disease and stable coronary artery disease with prior revascularization, who is presented in consultation for an aneurysm of the aorta in the juxtarenal abdominal aorta of 62mm. Angiography confirmed the presence of aortic aneurysm, which began at the level of the left renal artery and as significant finding determined the existence of two right accessory renal arteries and one left accessory renal artery. In addition, the right common iliac artery was also aneurysmatic (Figure 1).

Preoperative assessment classified the patient of high risk for conventional surgery (chronic obstructive pulmonary disease and anterolateral ischemia on stress test).

Before these circumstances it was proposed to the patient the aortic endograft with multiple fenestrations. This should have an orifice like “hollow punch” in the upper edge of the prosthesis (scallop) to preserve the flow in the celiac trunk and three fenestrations, one for the superior mesenteric artery and two for both main renal arteries. The scallops

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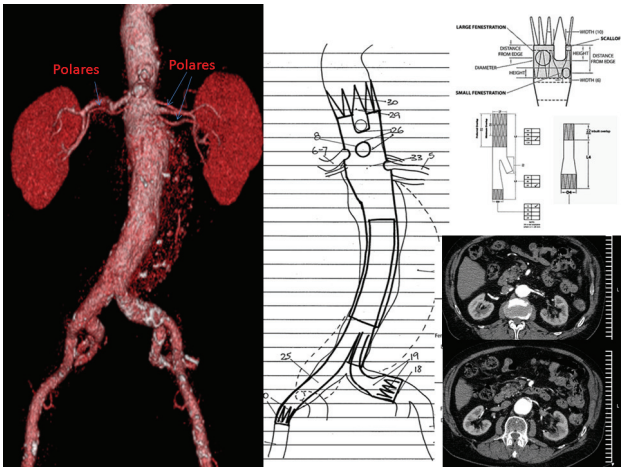

Fig. 1. Preoperative angiography that shows absence of infrarenal proximal neck, accessory renal arteries and aneurysmal dilatation of the right common iliac artery. To the right, axial tomographic cuts of the proximal neck and design project of the endograft where the fenestration and scallop are shown.

and the fenestrations are distinguished by their shape and location. The scallops are built at the proximal end of the endograft in a semicircular shape, while the fenestration, circular, is located in the body of the endograft. The construction of the endograft implies to direct the orifices along the entire circumference of the endograft, taking into account the distance from the start of prosthetic material too. Then it is established that an orifice at the time of 12:00 will be in the anterior face of the endograft and the one which is at the time of 9:00 will be oriented to the right. All these orifices are marked with radiopaque marks that allow their identification and orientation to match them with the visceral and renal orifices. These orifices, in order to preserve visceral irrigation allow suprarenal deployment of the endograft, which sets a larger contact area between the prosthetic material and aorta wall.

In this patient, all dilated right common iliac artery (26mm with circumferential mural thrombosis), previously, the internal iliac artery had to be embolized with coils and to end up anchoring the endograft in the external iliac artery. For scarce intraluminal space determined by the presence of thrombuses in its inside, they were discommended both, the use of an endograft with iliac branch as well as a conic iliac extension or elephant foot.

Based on tomographic studies, a prosthesic plan was made (see Figure 1). The endograft was then a first trunk with a scallop and three fenestrations, a second bifurcated distal aortic segment to determine a configuration bi-iliac and two iliac extensions. The device constructed was a Cook Zenith fenestrated endograft ZFEN-1000 32-mm proximal diameter and 154mm in length, with a scallop for the celiac trunk at the time of 12:00 (anterior face of the endograft) and a fenestration for superior mesentric artery of 8-mm, also at the time of 12:00 but 24mm from the superior edge. Furthermore, this body had a fenestration of 8 to 26mm of superior edge at the time of 9:00 to the right renal artery and a fenestration of 6mm to 40mm of superior edge at the time of 2:00 to the left renal artery. An additional aortic bifurcated extension and two extensions to the iliac arteries 12 and 24mm were prepared to fix the prosthesis in aorto-bi iliac position.

The procedure was carried out under regional anesthesia during which both femoral arteries were exposed by the usual technique. Primarily we proceeded to embolize the right internal iliac artery with coils. On the left femoral sheath was placed Extra-large 18 Fr Check-Flo introducer and within it, by two 6 Fr Flexor Check-Flo (Cook Group Inc. Bloomington, IN) introducers, they were selectively placed in a Rosen guide curve (Cook Group Inc. Bloomington, IN) in both kidneys to mark the aortic origin of each vessel. A third guide was placed in the superior mesenteric artery. Then the endograft advanced through the right femoral access on the Lundesquist Extra-Stiff (Cook Group Inc., Bloomington, IN) guide. Viewing under fluoroscopy the radiopaque marks of fenestrations, we proceeded to guide and locate the endograft, still sheathed, in oder to coincide the fenestrations with the ostia of the visceral and renal branches. Once the endograft was positioned, we proceeded to the partial opening of the main body, displaying fenestrations and their distal end. The endograft has a mechanism whereby may be partially open, which allow us to rotate and mobilize it longitudinally. Then, after opening the first body distally, each viseral branch was catheterized again but now from inside the endograft and through each fenestration (Figure 2 A). While the 6 Fr introducers were properly inserted in each renal artery, we proceeded to fully release the prosthesis, opening the proximal end and releasing the first row of uncoated stents with hooks. Afterwards, through each of 6Fr renal introducer they were placed coated stents with polytetrafluoroethylene (Advanta V12, Atrium Medical Corporation, NH), which were placed one third inside of the aortic prosthesis and two thirds inside the renal artery , opening up to nominal pressure (7 × 22 in the right renal artery and 6 × 22 on the left one) (Figure 2 B). Operation was repeated with a balloon catheter 12mm in diameter to open furthermore intraprosthesic portion of the stent for the complete opening and sealing of each branch (the last balloon was only inflated inside the endograft to achieve, by over-expansion, a perfect contact with the fenestration). In the superior mesenteric artery was placed a stent with uncoated expandable balloon. To complete this first stage, the carrier system of the prosthesis was withdrew. After a bifurcated distal aortic extension was placed. The procedure ended with the placement of two iliac extensions, one of 12mm distally anchored in the right external iliac artery and the second of 24mm in the left common iliac artery. A final angiographic control was carried out in order to check the complete exclusion of the aneurysm with patency of the four

visceral branches (Fig. 2 C). The time of the fluoroscopy was 62 minutes.

During post-operative, the patient developed a secondary reflex ileus to small bilateral renal infarctions, they were evidenced by tomogarphy, scheduled occlusion of accessory renal branches. However, there was no kidney failure or increased serum values of urea and creatinine.

In angiotomography control at 3 months was conformed the correct placement of the endograft without endoleaks (Figure 3), with patency of the four visceral vessels.

DISCUSSION

Several studies suggest that about 50% of patients with abdominal aortic aneurysms will be "ideal" candidates for endovascular repair with standard endograft on the basis of anatomical exclusion criteria. In recent years, certain anatomical challenges have been resolved due to new properties of different devices and this has allowed us even the treatment of patients with more complex anatomy. However, inadequate or adverse anatomy is one of the main predictors of failure, whether migration, endoleak or rupture. Despite the incorporation of more flexible, more accurate endografts of better proximal fixation mechanisms, anatomical inclusion criteria and, consequently, the instructions for their commercial use, they require an adequate length of proximal neck. In short infrarenal segments, sharply angled or calcified, it was reported a substantial rate of endoleaks. On the other hand, surgical repair in this context, could require a suprarenal or supraceliac clamping, which has been associated with a rate of ischemic complications, poor postoperative outcomes and mortality. Consequently, the advent of endovascular devices able to incorporate the renal and visceral aorta as sealing sites are a valuable tool to improve outcomes in this group of patients.

The treatment of aortic aneurysms with fenestrated endograft is a procedure that requires special attention, since the used tactics and techniques are completely different. They are essential a targeted training, a stock of specific materials and a technology in last generation images.

In the preoperative assessment of a detailed study which is led to know precisely the vascular anatomy and the feasibility of the procedure and focussed on the anatomical characteristics of the visceral aorta. With this information, the endograft is tailored manufactured .

The base of the fenestrated endograft is to increase the contact area between the endograft and the wall of the aorta, incorporating the visceral aortic as sealing zone. As an aggregate, the placement of a coated stent on visceral and renal arteries not only means a form of attachment, which prevents that the endograft moves, but also the complete sealing of the fenestration and aneurysm. In the market

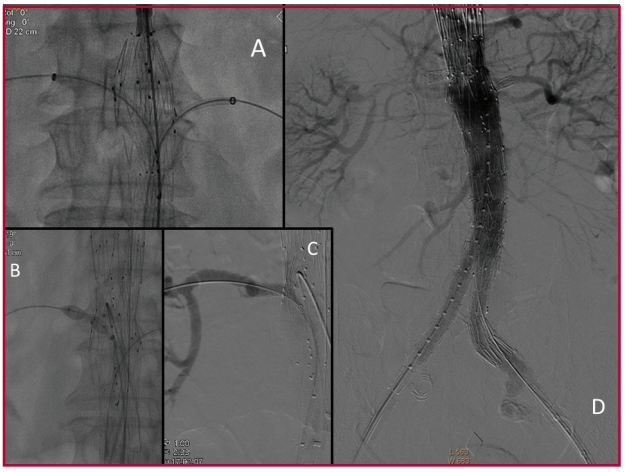

Fig. 2. Intraoperative angiography. **A.** The 6 Fr introductors come from inside the endograft into each renal artery. The proximal end of the endograft is folded. **B.** Polytetrafluoroethylene-covered stent that expands with balloon in the right renal artery and the angiographic result. **C.** where the seal of the respective fenestration and normal flow in the right renal artery. **D.** Final angiography with exclusion of the aneurysm.

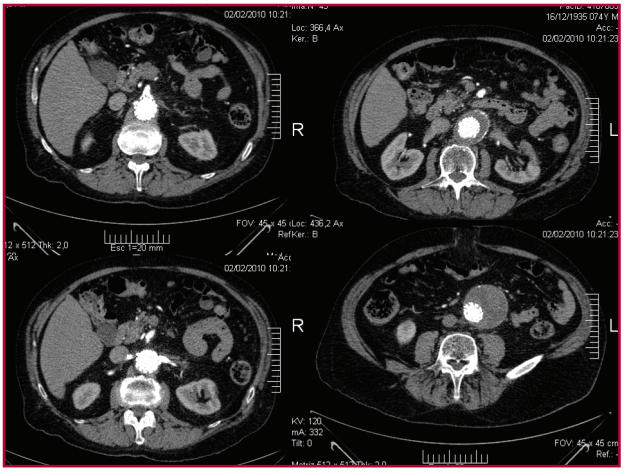

Fig. 3. Postoperative tomographic control that shows the exclusion of the aneurysm.

there are two types of endografts for preservation of visceral branches: fenestrated and with branches. The first ones are used in cases of infrarenal aneurysms without proximal neck or juxtarenal aneurysms, in which through fenestrations or scallops, correctly oriented, the visceral branches are preserved. By contrast, endografts with branches are used mainly in thoracoabdominal aneurysms.

This presentation corresponds to the first endovascular treatment using an endograft with multiple fenestrations in a patient with an aneurysm of the juxtarenal abdominal aorta. In ourenvironment, so far only two cases had been reported in which was used an endograft with a single branch or fenestration to a renal intra-aneurysmatic artery. (1, 2)

Worldwide experience with fenestrated endograft

is currently focused on a small number of services and cases around the world. A recent published article reported the med-term results of a prospective, multicenter study designed to evaluate the Zenith fenestrated endograft (Cook Medical, Bloomington, Indiana) for the treatment of juxtarenal abdominal aortic aneurysms with short proximal neck. (3) The study objectives aimed to evaluate the safety and preliminary efficacy of the device. It was carried out in five U.S. centers and included 30 patients. In the manufacture of the device, of three fenestrations was the most numerous (66.7%). All prostheses were implanted successfully. Visceral arteries were not occluded. There were not deaths, rupture or conversion. No patient developed a type I or III endoleak. At follow-up, 8 patients had a renal event (4 stenoses, 2 occlusions of renal artery and 2 renal infarctions). Five patients underwent secondary procedures. None of them had kidney failure requiring dialysis. These results are consistent with previous published studies from Cleveland Clinic or Europe and support the concept that the placement of fenestrated endovascular stent-grafting is safe and effective in experienced centers in the endovascular repair.(4-6)

Despite the versatility of this type of prosthesis, anatomic factors may complicate the design, manufacture or placement of the device. After the initial stent-graft placement is essention that the rotation movement may be maintained to properly orient the fenestrations. Sharply angled of the proximal neck or a small diameter, calcified or too tortuous aorta, in association with adverse iliac anatomy, will make difficult this task and increase the risk of acute loss of any visceral branch. Moreover, proximal bifurcation of renal artery or multiple renal arteries, which is observed with some frequency in patients with aortic aneurysms, hampers the ability of the stent to seal the fenestration. This adds a level of complexity to the procedure and might increase the risk of loss of renal parenchyma. In addition, fenestrated procedures consume more time of surgery than conventional infrarenal ones and they require longer fluoroscopy and contrast media. In this patient, we only find two main renal arteries and other three small polar possible arteries to sacrifice, especially regarding the risk of aneurysm rupture, surgical risk for conventional surgery.

CONCLUSIONS

There is an important population of patients with hitherto intractable aneurysms with endovascular approach, high risk for open repair, and relegated to medical treatment. The endovascular treatment with frenestrated endograft and/or branching is a new therapeutic optiom with promising results for patients who are considered unfit for conventional open repair. In these procedures is essential to have special training, technology and necessary elements to obtain a proper result. However, studies at long-term follow up are needed in order to draw solid conclusions.

RESUMEN

Experiencia con prótesis endovascular con múltiples fenestraciones. Descripción de un caso

En los pacientes con un aneurisma de la aorta abdominal yuxtarrenal, el segmento normal de aorta infrarrenal necesario para lograr el anclaje proximal de una endoprótesis es insuficiente o inexistente, por lo que con las endoprótesis tradicionales no existe la posibilidad de sellar o excluir el aneurisma. Por este motivo, en los últimos años se han utilizado endoprótesis con fenestraciones (orificios) para la preservación de los ramos viscerales y renales como alternativa válida y menos invasiva.

En esta presentación se describe el primer caso de un aneurisma aórtico yuxtarrenal tratado en nuestro país mediante la colocación de una endoprótesis con múltiples fenestraciones. Se trata de un paciente de alto riesgo quirúrgico por comorbilidades clínicas, al cual con empleo de anestesia regional se le colocó una endoprótesis con fenestraciones para preservar la irrigación del tronco celíaco, la arteria mesentérica superior y ambas arterias renales. El procedimiento fue exitoso, lográndose la exclusión del aneurisma. El primer control posoperatorio demostró la exclusión del aneurisma con permeabilidad adecuada de los ramos viscerales.

Palabras clave > Aneurisma aórtico abdominal - Prótesis vascular

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