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CHIMNEY-GRAFT TECHNIQUE TO TREAT A TYPE IA ENDOLEAK AFTER A PREVIOUS EVAR

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A 73 year old man who underwent an elective EVAR procedure in 2014 for an infrarenal AAA presented two years later with a type IA endoleak. The CTA showed a distal migration of the proximal part of the stent graft resulting in a type IA endoleak. In order to treat this new diagnosed endoleak an endovascular repair using chimney technique (with a snorkel-stent graft in the renal artery-bilaterally) with proximal extension of sealing zone with an endovascular aortic cuff has been undergone with implantation of a stent graft in the right renal artery as a periscope and a chimney in the left renal artery. Subsequently, an Endurant II Aortic Cuff was implanted. The whole procedure was performed using CO_2 instead of iodinated contrast medium. In the 5 month follow-up with abdominal ultrasonography no endoleak could be identified with stabilization of aneurysmal sac diameter. The use of chimney technique adds an additional tool to the armamentarium of endovascular surgeon to deal with the complex type IA endoleaks.

Keywords: *Abdominal aneurysm, CO_2 angiography, chimney-graft technique, type IA endoleak, periscope technique.*

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ИСПОЛЬЗОВАНИЕ ТЕХНИКИ «CHIMNEY» В УСТРАНЕНИИ ЭНДОЛИКА IA ТИПА ПОСЛЕ ЭНДОПРОТЕЗИРОВАНИЯ БРЮШНОЙ АОРТЫ ПРИ ЕЁ АНЕВРИЗМЕ

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Представлен случай устранения эндолика IA типа у 73 летнего пациента, которому в 2014 году была проведена плановая процедура имплантации эндографта по поводу инфраренальной аневризмы брюшной аорты. По данным компьютерной томографии была установлена дистальная миграция проксимальной части эндографта, что привело к развитию эндолика IA типа. Процедура эндоваскулярного восстановления с использованием chimney technique (snorkel-stent обеих почечных артерий) с проксимальной экстензией зоны фиксации с помощью эндоваскулярной манжеты завершена имплантацией стент-графта в правую почечную артерию periscope техникой, а в левую – техникой chimney. Имплантирована аортальная манжета Endurant II. Процедура выполнена с помощью CO_2 контрастирования, вместо йодсодержащего контрастного вещества. Через 5 месяцев, при УЗИ брюшной полости, эндолики не выявлены, диаметр аневризмы стабилен. Использование periscope и chimney техник является дополнительным инструментом для борьбы с серьёзными осложнениями, присущими для эндолика типа IA.

Ключевые слова: *аневризма аорты, CO_2 ангиография, chimney техника, periscope техника, IA тип эндолика.*

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Introduction

The abdominal aortic aneurysm (AAA) is associated with a high risk of rupture and mortality [1]. In the last decade, the endovascular aortic aneurysm repair (EVAR) became the key method of treatment of infrarenal AAA. Despite the advantages of EVAR it raises a number of serious specific complications, of which endoleaks are the most common and may require further endovascular intervention or even open repair in order to prevent a further aneurysm growth and a possible rupture. The real incidence of type I endoleak is not specified but according to the data of The European Multicenter Experience of Endovascular Aortic Aneurysm Repair with the Endurant Stent-graft, the endoleak type I has been detected in 2.2% of patients in the first year after EVAR procedure [2]. The results of Endurant stent graft System in the US demonstrated a 99.2% freedom from aneurysm-related mortality after 4 years of follow-up [3].

Cases of aneurysm related death due to rupture caused by persistent type IA endoleak have been reported [4-6]. Treatment options for the type IA endoleak after EVAR are open conversion surgery and more frequently including endovascular procedures and one of the options is to extend the proximal sealing zone of the implanted stent graft. In the present work, we report the use of chimney-graft technique to treat a type IA endoleak in a AAA-patient treated previously with an EVAR procedure.

Case report

A 73 year old man who underwent an elective EVAR procedure in 2014 for an infrarenal AAA presented two years later with a type IA endoleak seen on a computed tomography angiography (CTA) scan with a 3 mm increased diameter of the aneurysmal sac. The CTA showed a distal migration of the proximal part of the stent graft resulting in a type IA endoleak (Fig 1).

The diameter and length of the aortic neck before the first EVAR were 22 mm and 24 mm respectively. The angulations were α-angle=82° and β-angle=25° respectively. The preoperative comorbidities included arterial hypertension, a history of myocardial infarction, and a history of appendectomy and hernia. The patient had no aneurysm-related symptoms. In order to treat this new diagnosed endoleak we planned to perform an endovascular repair using chimney technique (with a snorkel-stent graft in the renal artery-bilaterally) with proximal extension of sealing zone with an

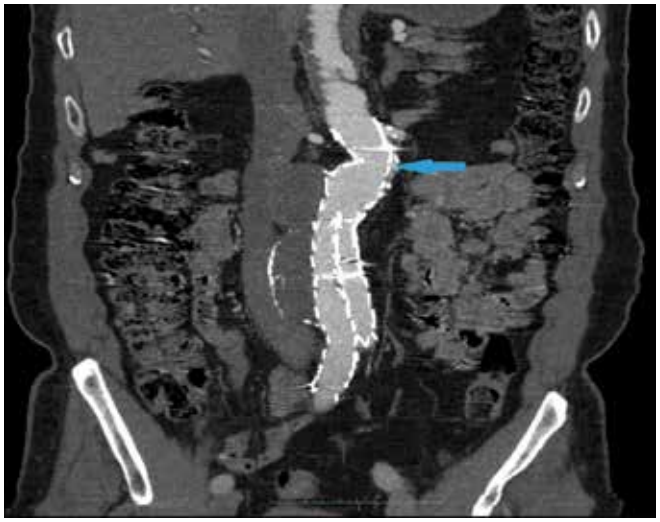

Fig 1 *Preoperative CT-Angiography shows the type IA endoleak at the proximal end of endostent (arrow)*

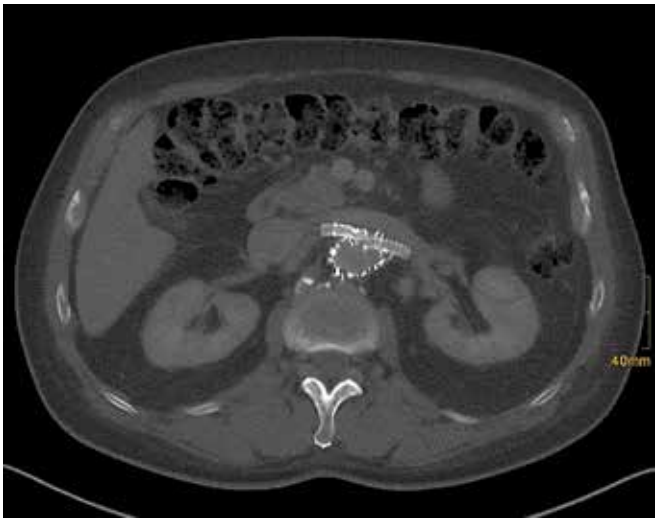

Fig 2 *Postoperative CT-Angiography. The renal arteries are perfused through the implanted stent grafts (as chimney on the right side and as periscope at the left). No more endoleak to be seen*

endovascular aortic cuff. During the operation, the right renal artery could not be cannulated through the trans-axillary access so that we decided to implant the stent graft in the right renal artery as a periscope (Viabahn 6 mm × 5 cm, W.L. Gore & Associate, Flagstaff, Arizona, USA) after cannulation through a femoral access and a chimney in the left renal artery trans-axillary (Advanta 6 mm × 38 mm, Maquet, Rastatt, Germany). Subsequently, an Endurant II Aortic Cuff (proximal and distal cuff diameter were 36 mm with a length of 49 mm) was implanted (Medtronic Inc., Fridley, Minnesota, USA). The whole procedure was performed using CO_2 instead of iodinated contrast medium (the preoperative estimated glomerular filtration rate was 60 ml/min).

The postoperatively performed CTA showed that the endoleak type IA had disappeared (Fig 2, 3).

No complications in the post-operative period were observed. In the 5 month follow-up with abdominal ultrasonography no endoleak could be identified with stabilization of aneurysmal sac diameter.

Discussion

In the recent years, EVAR is becoming more popular. Accumulated experience, as well as creation of new generations of stent-grafts led to a significant reduction of the perioperative complications [7]. The most frequent complication of EVAR is the development of endoleaks that in many cases require repeated interventions and sometime even an open conversion [4, 5]. One of the rare complications in the postoperative period after EVAR but which is potentially dangerous in term of aneurysm rupture is the type IA endoleak which is called the Achilles heel of EVAR.

According to the ENGAGE Registry in which 1262 patients with infrarenal AAA treated endovascularly (EVAR) using Endurant stent graft from 79 sites in 30 countries were recruited, endoleaks could be identified in 138 (12.0%) patients at 30 days thereof 17 (1.5%) were type I and/or type III. Only one patient had both types present [8].

Causes leading to the formation of type IA endoleak include hostile neck, inappropriate pre-procedural planning, material used outside instructions for use, intra-procedural mistakes, severe angulation of the neck, further progress of the aneurysmal disease and stent migration [9]. In another work, Pecoraro et al [10], compared the results of EVAR procedures using Endurant II stent graft according to the instructions for use versus off-label use in high-risk patients. The authors did not identify any type I endoleaks during a mean follow-up period of 22.61±12 months in the off-label group. However, in their systematic review, Antoniou GA et al [11] had demonstrated that type I endoleak was observed in 10% and 1% in patients' group treated with EVAR with hostile and normal anatomy respectively after 1 year of follow up. Also, Troisi N et al [12],

Fig 3 *3D reconstruction of the postoperative CTA demonstrating the final configuration of the undergone endovascular solution*

showed in their work, based on an univariate analysis, that proximal aortic neck length ≤10 mm, presence of proximal neck thrombus and the chimney technique significantly affect midterm freedom from types I/III endoleak (mean follow up period was 9 month). Studying the factors that might augment the risk of developing proximal neck complications after endovascular aneurysm repair using the Endurant stent-graft, Bastos F identified that neck length <10 mm and presence of neck thrombus/calcification were independent risk factors for intra-operative neck related adverse events. Also, the female gender, neck length <10 mm, and AAA maximum diameter ≥65 mm were identified as independent risk factors for postoperative neck related adverse events [13].

Different approaches were applied to treat the endoleak type IA, including endovascular approach and open procedures. Type I endoleaks can be treated with aortic cuff extension, angioplasty at the sealing zone, use of Palmaz stent, use of fenestrated or branched stent grafts, implantation of parallel grafts and embolization using glue or coils [9].

In our case, the patient had two risk factors for developing type IA endoleak: severe neck angulation and the migration of the endoprosthesis as mentioned above. We performed a "neck lengthening" and placement of chimney and periscope grafts in the renal arteries successfully with no relevant postoperative complication. Montelione et al [14], described their experience of treatment of 23 proximal and 1 distal type I endoleak after EVAR using chimney and/or periscope grafts. The reported technical success was 96%; one patient required an additional procedure to seal a recurrent type IA endoleak. Authors identified the estimated survival at 12, 24, and 36 months as 83%; estimated chimney and/or periscope grafts patency at the same intervals was 94%. Similarly, Donas KP et al [15] reported in their work outcomes of 18 high-risk patients with prior EVAR or chimney-EVAR with type IA endoleak were treated by the chimney technique. Technical success was 94.4% with no early procedure-related death. Also primary patency of the chimney grafts was 96.7%, and assisted primary patency was 100%. Also chimney procedure can be option for treatment of type IA endoleak after previous chimney EVAR [16].

In conclusion, the type IA endoleak represents a cumbersome problem after EVAR. However, the multiple modalities of treatment options including the endovascular repair, and as we described in our case, the use of chimney technique gives the surgeon additional possibilities to deal with this problem.

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