Volume 5 Issue 1 January 2023 ISSN 2732-7175

Hellenic Society of Vascular and Endovascular Surgery

Hellenic Journal of Vascular and Endovascular Surgery

HOT TOPICS

European training requirements in vascular surgery
Porto, Portugal and Athens, Greece

Importance of Fusion Software in Type II endoleaks treatment after EVAR
Campobasso and Rome, Italy

Single center experience with fenestrated and branched endovascular repair (F/BEVAR) for pararenal and thoracoabdominal aortic aneurysms
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Volume 5 • Issue 1 • 2023

Hellenic Journal of Vascular and Endovascular Surgery

Volume 5 • Issue 1 • 2023

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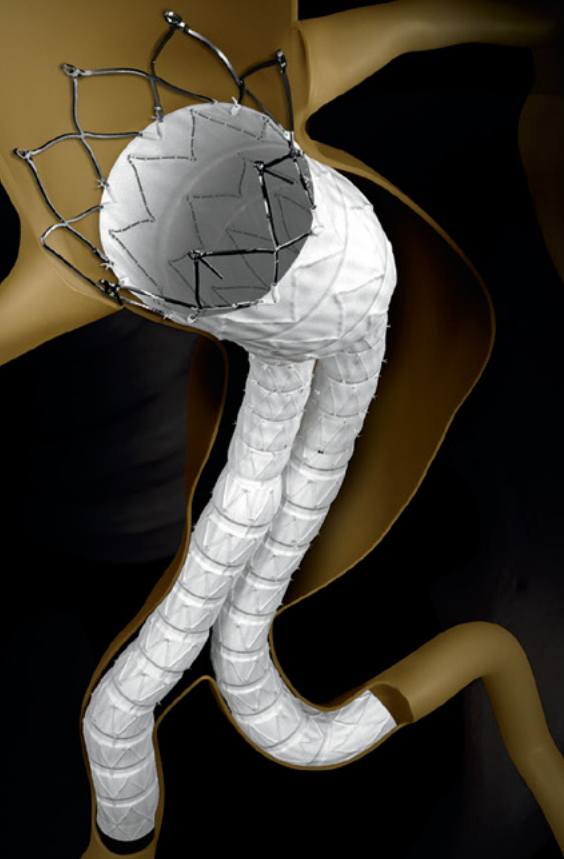

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EDITORIAL

European training requirements in vascular surgery

Armando Mansilha[1], John Kakisis[2]

[1] UEMS Section and Board of Vascular Surgery, Faculty of Medicine, University of Porto, Porto, Portugal
[2] UEMS Section and Board of Vascular Surgery, Greece

Key Words: training, vascular surgery, UEMS

The Section of Vascular Surgery became independent and separate within the UEMS in 2004, with the main objective defined as "to guarantee the highest standards of care in the field of the Vascular Surgery in the countries of the EU, by ensuring that the training of the specialist doctor is raised to the highest possible level".[1] This goal follows the UEMS conviction that the quality of medical care and expertise is directly linked to the quality of training provided to the medical professionals. Consequently, the UEMS Section and Board of Vascular Surgery committed itself to the improvement of vascular surgical training in Europe through the development of European Standards, so that, regardless of where the vascular surgeons are trained, they would have at least the same core competencies. In this context, the UEMS Section and Board of Vascular Surgery has recently published a guideline document entitled "European training requirements in vascular surgery" focusing on the required competencies of a vascular surgeon as well as on the suggested ways to document and assess them.

The content of training is divided into three main areas: theoretical knowledge, practical skills and professional attitudes. Theoretical knowledge should cover the whole spectrum of arterial, venous and lymphatic diseases, including prevention, diagnosis and treatment. This is a traditional requirement and there is nothing unexpected in it. In the acquisition of practical skills, however, there has been a paradigm shift. The guideline document does not describe a minimum number of procedures that a vascular trainee should have performed before being considered as a proficient vascular surgeon. Instead, the focus of training is moved from time- and process-based to competency-based training. The decisive factor is what the trainee is able to do, not the number of procedures he/she has observed or performed. In other words, the goal of training is the mastery of skills that allows for unsupervised practice, not the achievement of minimum numbers. In any case, technical skills are divided into basic, intermediate and advanced and should be acquired through observation, performance with assistance and performance without assistance. The whole training process is continuously monitored to verify that the achieved level of competency meets the expectations.

Author for correspondence:

John Kakisis

Department of Vascular Surgery, Medical School
National and Kapodistrian University of Athens
Attikon University Hospital, Athens, Greece
Rimini 1, Haidari. 12462, Athens
E-mail: kakisis@med.uoa.gr
doi: 10.59037/hjves.v5i1.23
ISSN 2732-7175 / 2023 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications

Professionalism is another integral part of the vascular trainees' curriculum, often underestimated by both trainers and trainees. It is recommended that the curriculum includes basic knowledge of scientific methodology and principles of clinical research, ethics, patient rights and protection of privacy, national and European legislation related to health care and legal rules of employment and working conditions. Commitment to patients and society, appropriate professional behaviors and commitment to excellence in all aspects of practice should be taught and monitored through patient and staff feedback.

The training period in vascular surgery should be sufficient to ensure that the trainee has reached the required level of competency. The minimum duration of training is recommended to be 5 years, whereas a duration of up to 7 years may be considered appropriate by national authorities. The first two years should be focused on developing basic patient care and technical skills, whereas the following years should be focused in vascular and endovascular surgery. Training in vascular ultrasound is a sine qua non in contemporary vascular surgery and should be incorporated in the curriculum of training, either as a separate educational section or a daily/weekly activity. Inclusion of simulators, wet labs and vascular research activities is also encouraged. The theoretical part should be covered by an education program consisting of lectures (including visiting speakers), clinical case presentations, conferences (including the National Society and the European Society for Vascular Surgery annual meeting), journal clubs, mortality and morbidity meetings, research meetings, teaching in ethics, administration, management and economics, as well as radiation protection courses.

During the training, vascular surgery trainees should re-

ceive continuous feedback and evaluation. The "entrustable professional activities" (EPAs) for vascular surgery is a workplace assessment tool that could be used on a regular base to provide an immediate and structured feedback. All operations and interventions should also be documented in a logbook. The FEBVS Exam (Fellow of the European Board of Vascular Surgery) could serve as a comprehensive final assessment, during which the candidates will have to discuss a scientific paper, discuss and evaluate clinical cases, explain clinical situations and perform practical work on a model or simulator (skills assessment).

The other pole of a training program is the trainer, who is expected to create a positive learning climate, show professional attitude towards residents, communicate learning goals, evaluate the residents and provide feedback to them. Trainers must be positive role models demonstrating good medical practice. They are expected to maintain knowledge and skills on an ongoing basis through continuing professional development. In that respect, the creation of "Training the trainers" programs is highly recommended.

The teaching institution must possess all the necessary infrastructure to provide training in vascular surgery, including a diverse and sufficiently large inpatient and outpatient service, adequate teaching staff, operating theatres, angio-(hybrid) suites, appropriate equipment and other (theoretical) learning facilities. The number of training positions must be in accordance with the resources of the training center and the manpower planning projection of each EU national state. Importantly, training institutions should be recognized and accredited by national authorities. Internal and external auditing, regular reports and transparency of programmed training through the publication of details of the training program are essential parts of quality management within training institutions.

The UEMS Section and Board of Vascular Surgery does not have the will or the means to enforce these requirements. However, according to the Merriam-Webster dictionary, the word "requirement" is defined as "something essential to the existence or occurrence of something else". In light of this, we should all embrace these requirements and try to fulfil them in our everyday practice as they are "essential to the existence" of a high level and harmonized within European countries training program for the next generation of vascular surgery specialists.

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Importance of Fusion Software in Type II endoleaks treatment after EVAR

Pietro Modugno MD[1,*], Pierfrancesco Antonio Annuvolo MD[2,*], Enrico Centritto MD[1], Pasquale Astore[3], Luigi Di Martino[3], Veronica Picone MD[1], Maurizio Maiorano MD[1], Savino Cilla MD PhD[4], Yamume Tshomba MD[2]

[1] Unit of Vascular Surgery, Gemelli Molise Hospital, Campobasso, Italy
[2] Unit of Vascular Surgery, Fondazione Policlinico Universitario Gemelli IRCCS - Università Cattolica del Sacro Cuore, Rome, Italy
[3] Cardiocirculatory Perfusion Technical Service, Gemelli Molise Hospital, Campobasso, Italy
[4] Medical Physics Unit, Gemelli Molise Hospital, Campobasso, Italy

*The two authors share the authorship.
All authors contributed equally to this manuscript. All authors reviewed the results and approved the final version of the manuscript.

Abstract:

Objectives: Introduction and objective: The presence in the CT-angiography (CTA) system of a "vessel navigation" engine equipped with a co-registration and navigation software (Fusion) allow for greater diagnostic accuracy and to precisely identify the "Target Vessel" in Type II endoleaks treatment after EVAR.

The aim of this preliminary study is to demonstrate the feasibility of “Fusion” software to reduce the amount of contrast medium and radiation dose to patients and the time of procedure.

Methods: Between 2020 and 2022, we treated 12 patients for type II endoleak after EVAR.

We divided the patients in two groups: a Group A (n=7) of patients treated using a new high-end angiograph (International Tools Wokstation, Philips), equipped with the "Fusion” software; a Group B (n=5) of patients treated without it. The amount of contrast medium and the Dose Area Product (DAP) were recorded and compared between the two groups.

Results: We found no death or need for surgical conversion in both groups. The amount of contrast medium injected was similar between the two groups. A dramatic reduction of the DAP was observed for group A compared with group B. The DAP median values were 4.9 Gy x cm^2 (range: 3.2-21.1 Gy x cm^2) for group A and 9.76 Gy x cm^2 (range: 6.3-11.75 Gy x cm^2) for group B. Shorter times of procedures for Group A patients were recorded, with a median value of 72 minutes compared to 53 minutes for Group B.

Conclusion: The use of the “Fusion” software as "vessel navigator” during the embolization procedure of the type II endoleaks guarantees a greater efficacy in the endovascular treatment but also a dramatic reduction of the amount of radiation needed for the treatment, with great benefits from a radiation protection point of view for both the patient and the healthcare operator.

INTRODUCTION

Endovascular abdominal aortic aneurysm repair (EVAR) is a less invasive but equally effective technique to treat aneurysm compared to open surgery repair (OSR). EVAR has been shown to have lower 30-day mortality and morbidity rates than OSR. However long and medium-term follow up results have shown that the early benefit is lost over time.

Type I endoleak, type II endoleak with sac expansion, type III endoleak, stent migration and kinking were associated with an increased risk of rupture[1].

Endoleak is defined as continued perfusion of the aneurysm sac despite endograft deployment; therefore, the aneurysm sac is not completely excluded from the systemic circulation.

Different types of endoleak have been described in the literature depending on the origin of the leak[2]. Type II are the most common endoleaks after EVAR and are caused by backflow of collateral arteries into the aneurysm sac [Fig. 1].

The most common arterial branches that give rise to type II endoleak are the inferior mesenteric artery and lumbar arteries.

Several treatments are available for Type II endoleaks after EVAR such as conversion to open surgery, embolization and

Author for correspondence:

Pierfrancesco Antonio Annuvolo MD

Unit of Vascular Surgery, Fondazione Policlinico Universitario Gemelli IRCCS - Università Cattolica del Sacro Cuore, Largo Agostino Gemelli 8, 00168 Rome, Italy
E-mail: antoannuvolo@gmail.com
doi: 10.59037/hjves.v5i1.32
ISSN 2732-7175 / 2023 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications

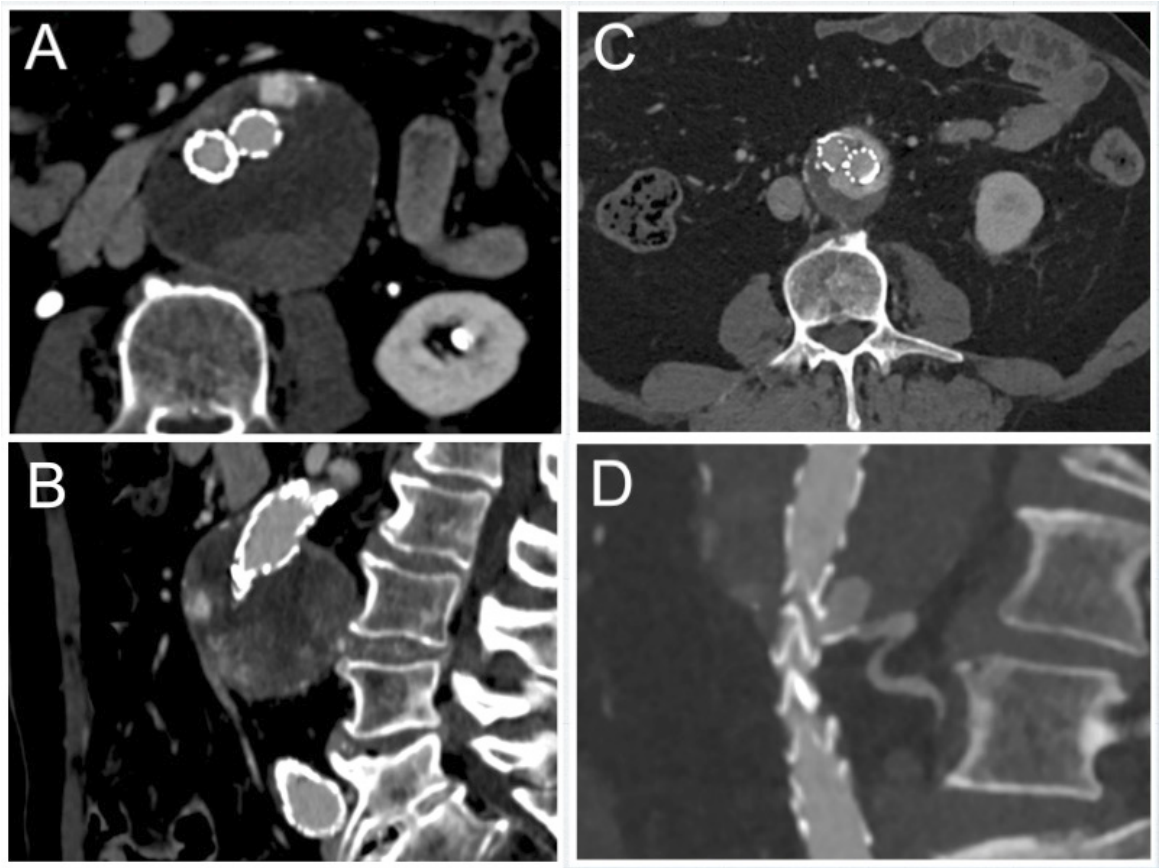

Fig.1: CT scan images showing a Type II endoleak in the aneurysm sac (A, C); example of inferior mesenteric artery (B) and lumbar artery (D) giving rise to the endoleak.

laparoscopic clipping.

The most common and effective techniques are the transarterial embolizations or direct percutaneous sac injection by translumbar or transabdominal approaches[3].

A review from Ameli-Renani et al.[4] described Type 2 endoleak management, with embolization as the mainstay treatment reserved for persistent cases with a significant sac size increase.

These procedures are all performed in an angiography suite using fluoroscopy and a wide variety of embolic agents such as coils, ethylene-vinyl-alcohol copolymer, glue[5].

The presence in the CT-angiography (CTA) system of a "vessel navigation" engine equipped with a co-registration and navigation software (Fusion) allow the coupling of actual CTA images acquired during the procedure with the pre-operative ones.

First, a 3D model is generated from preoperative imaging, typically a CTA. The model is then used in the procedure's planning, with specific markers placement (e.g. at the ostium of the target vessels) and storing of C-arm angles that will be used for intra-operative guidance. At the time of the procedure, an intraoperative cone-beam CT is performed and the 3D model is aligned to the patient' anatomy. Finally, the 3D model coupled to the fluoroscopic image is used for live guidance [Fig. 2].

This allows for greater diagnostic accuracy and to precisely identify the "Target Vessel" to be embolized to effectively treat the endoleak nidus, with a potential reduction of amount of contrast medium and patient's irradiation[6].

There are many applications for image fusion in endovascular surgery, such as for endovascular aneurysm repair (EVAR), complex EVAR, thoracic endovascular aneurysm repair (TEVAR), carotid stenting and for Type 2 endoleaks.

The aim of this preliminary study was to demonstrate the feasibility of "Fusion" software to reduce the amount of contrast medium and radiation dose to patients and the time of the procedure.

MATERIALS AND METHODS:

We collected data from patients treated in our Institution and then we performed a single-center retrospective analysis: one hundred-eighteen patients (median age: 73 years, 109 men and 9 women, 115 asymptomatic and 3 symptomatic/ruptured) underwent endovascular treatment for abdominal aortic aneurysm between 2020 and 2022.

All the patients performed standard EVAR to treat infrarenal abdominal aortic aneurysms (mean sac diameter 59 mm, all inside IFU). After the procedures a 6-months follow-up CTA was performed.

12 of these patients presented a type II endoleak with significant increase (> 5 mm) in the aneurysm sac that we treated with endoleak embolization.

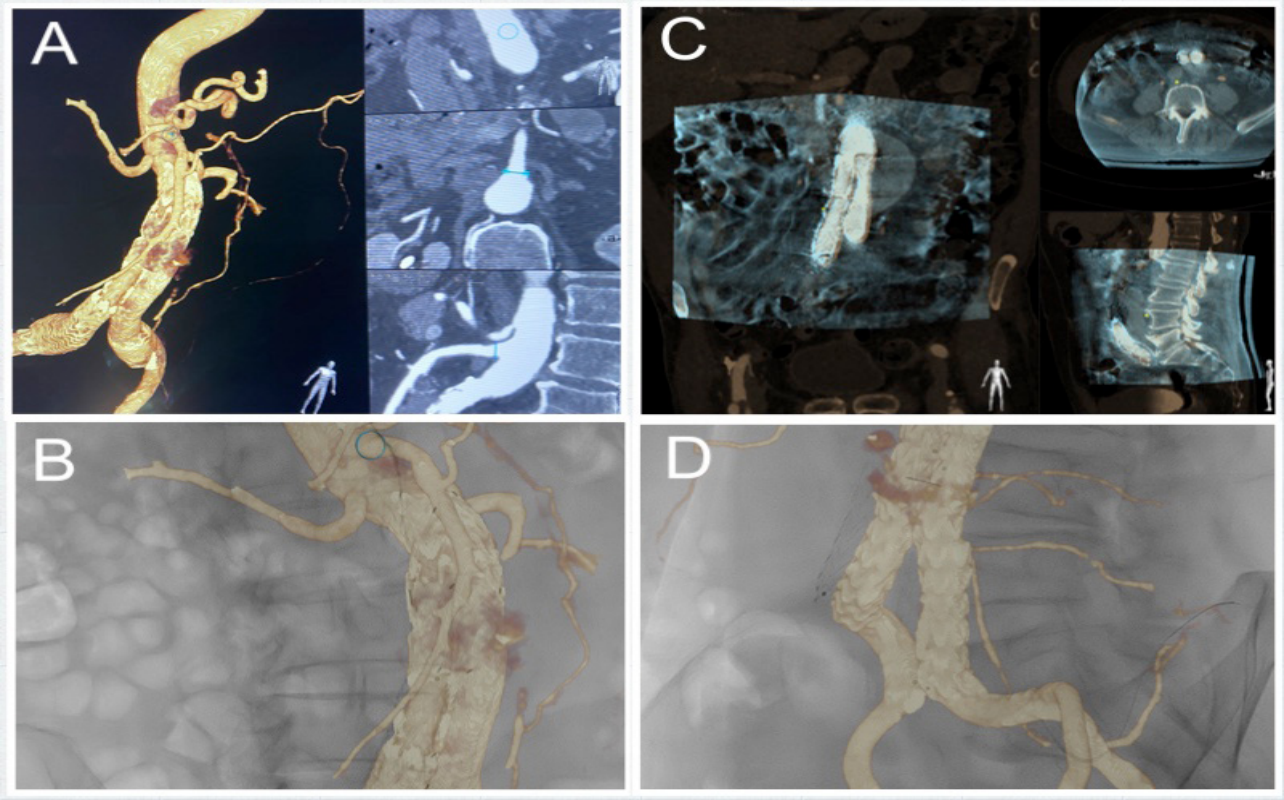

Fig. 2: CT- angiography (CTA) with "vessel navigation" engine equipped with a co-registration and navigation software "Fusion" (A); coupling of live images acquired during the procedure with the pre-operative CTA scan images (C); examples of Fusion-guided cannulation of target vessels (B, D).

All these patients had at least one patent aortic side branch (inferior mesenteric artery and/or lumbar arteries) at the pre-operative CTA. 10 patients were on antiplatelet therapy, 2 patients were on oral anticoagulation.

Embolizations were performed by the same physician in all cases. Through a 6-months follow-up CTA we found a decrease of the mean sac diameter (0.4 mm, range: 0.2-0.7 mm).

For all the patients we used controlled release coils by a transarterial approach, using two different angiographic equipment's.

We divided the patients in two groups with no significant differences in baseline characteristics: 7 patients treated using a new high-end angiograph (International Tools Wokstation, Philips), equipped with the "Fusion" software (Group A); 5 patients treated without it (Group B). The amount of contrast medium and the Dose Area Product (DAP) were recorded and compared between the two groups.

RESULTS

We found no death in either Group A or Group B patients. No surgical approach to endoleaks treatment, nor for surgical conversion, was needed.

Only one patient of Group A could not complete embolization of the target vessel afferent to endoleak nidus, while the size of the aneurysm sac remained stable. In all the other patients the procedure was performed completely.

The amount of contrast medium injected was similar between the two groups with a median of 160 ml (range: 100-200 ml) for group A versus a median value of 180 ml (range: 100-350) for group B.

A dramatic reduction of the DAP was observed for group A compared with group B. The DAP median values were 4.9 Gy x cm^2 (range:3.2-21.1 Gy x cm^2) for group A and 9.76 Gy x cm^2 (range: 6.3-11.75 Gy x cm^2) for group B. Shorter times of procedures for Group A patients were recorded, with a median value of 72 minutes compared to 53 minutes for Group B.

DISCUSSION

Nowadays, Type II endoleaks (EL) management is still a topic of debate among the vascular surgeons and interventionists.

Current guidelines recommend conservative treatment for Type II EL; however, if there is a significant increasing of the aneurysm sac (more then 10 mm), a secondary intervention is recommended.

Several authors have described their experience about this topic.

Some studies suggest the safety of a conservative approach, even in case of increasing aneurysm diameter. In this comparative study of 2018 pts, Mulay et al. highlighted no differences in overall survival between patients with and without Type II EL, and no difference in survival between patients who underwent a secondary intervention and those who not[7].

Other studies propose an intervention when the aneurysmal sac enlarges or if the endoleaks does not resolve within 6

months of operation[8].

Moulakakis et al. reported that endovascular approach should be the preferred treatment option, while open repair should be reserved for good risk patients with multiple feeding arteries, considering his better results in sac exclusion but more serious complications[9].

In this review[10], Hajibandeh et al. evaluated that conservative management of persistent Type II EL in the absence of sac expansion might be the appropriate approach. On the other hand, where intervention is indicated, occult type I and III endoleaks should be excluded by imaging.

Long-term surveillance is necessary after successful treatment of Type II EL as recurrence is common.

As mentioned above, several treatments are available for Type II endoleaks after EVAR.

The most common and effective techniques are the transarterial or translumbar embolizations.

Recently, many new radiological techniques have been developed to facilitate the interventional approach to Type II EL.

One of the major advances in imaging guidance for vascular procedures during the last decade has been the commercialization of cone-beam computed tomography (CBCT), a technology that provides three-dimensional rendering of opacified vascular structures.

There is emerging application of CBCT fusion with magnetic resonance angiography (MRA) or computed tomographic angiography (CTA) that has been shown to improve the technical success of many arterial and venous procedures, such as Type II EL embolization[11].

Many authors have described the feasibility and utility of the Fusion - a "vessel navigation" engine equipped with a co-registration and navigation software that allow the coupling of actual CTA images acquired during the procedure with the pre-operative ones - in vascular procedures[12].

With our study we want to confirm literature data about the Fusion software potential to improve technical success rates of transarterial embolization of Type II EL. Additionally, we want to demonstrate his feasibility in decreasing of radiation dose for both the patient and the healthcare operator.

CONCLUSIONS

The use of the "Fusion" software as "vessel navigator" during the embolization procedure of the Type II endoleaks allows to highlight the path of the target vessel that feeds the endoleaks nidus.

This software guarantees not only a greater efficacy in the endovascular treatment but also a dramatic reduction of the amount of radiation needed for the treatment, with great benefits from a radiation protection point of view for both the patient and the healthcare operator.

INFORMED CONSENT

Informed consent was obtained from the patient for publication of this Case report and any accompanying images.

CONFLICT OF INTEREST

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

FUNDINGS

The authors received no financial support for the research, authorship, and/or publication of this article.

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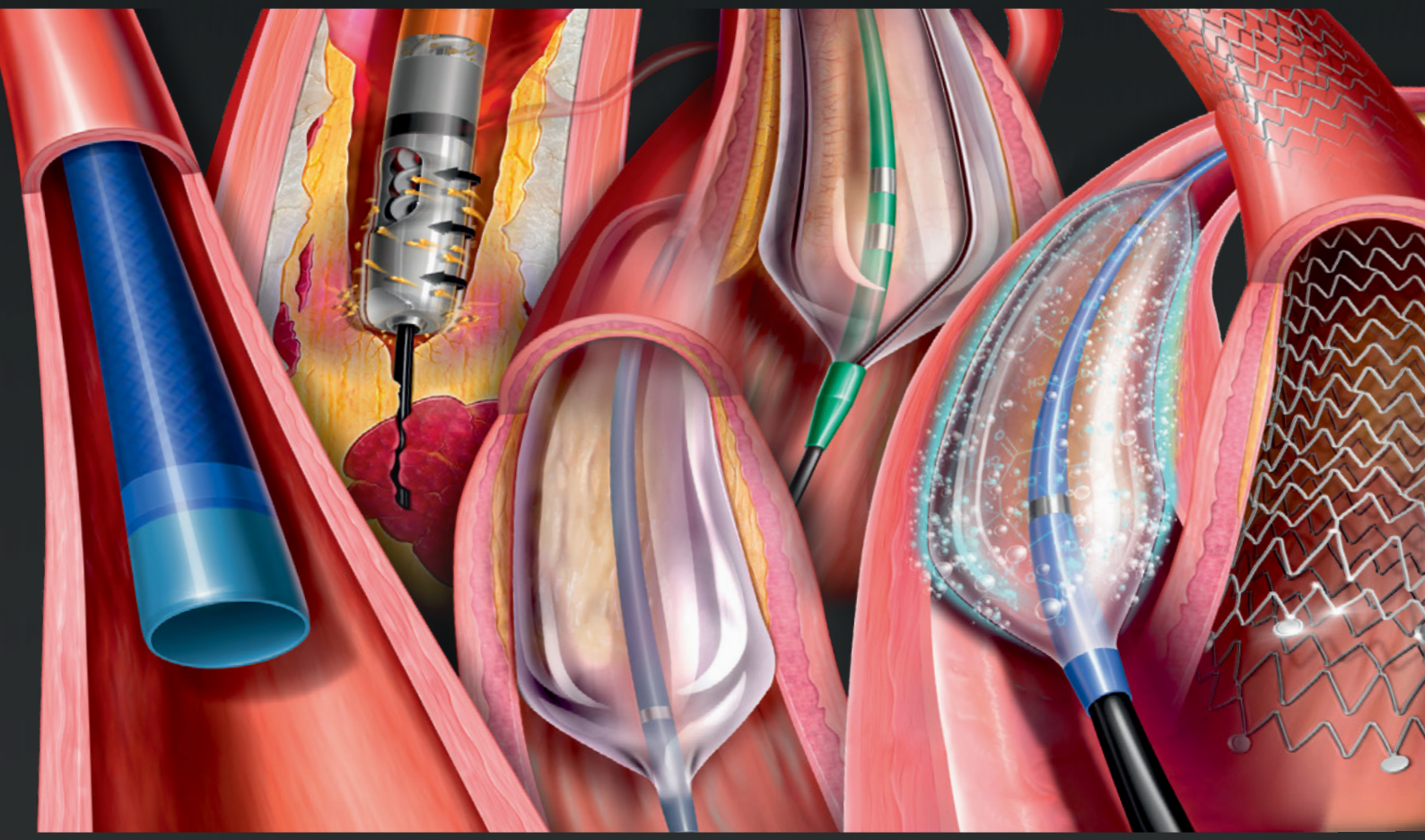

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Single center experience with fenestrated and branched endovascular repair (F/BEVAR) for pararenal and thoracoabdominal aortic aneurysms

Athanasios Katsargyris, MD, PhD, Natasha Hasemaki, MD, Antonia Skotsimara, MD, Ilias Avgerinos, MD, Michail Tsotsios, MD, Christos Bakogiannis, MD, PhD, Sotirios Georgopoulos, MD, PhD, Chris Klonaris, MD, PhD

2nd Department of Vascular Surgery, National and Kaposidstrian University of Athens, Medical School, Laiko General Hospital. Athens, Greece

Abstract:

Objectives: To report preliminary outcomes of fenestrated and branched endovascular repair (F/BEVAR) for pararenal aortic aneurysms (PAA) and thoracoabdominal aortic aneurysms (TAAA) in a single center.

Materials and Methods: Consecutive patients treated with F/BEVAR for PAA or TAAA within the period July 2021 - March 2023 were included. Perioperative and early follow-up outcomes were analyzed.

Results: During the study period, 35 patients (33 male, mean age 72.6 ± 7.8 years) were treated. Twenty-one (60.0%) patients were treated for a TAAA and 14 (40.0%) for a PAA. Fourteen (40.0%) patients had previously undergone one or more open/endovascular aortic procedures. Five (14.3%) patients had an acute aneurysm. Mean operative time was 240 ± 65min. Technical success was achieved in 33 (94.3%) patients. Thirty-day operative mortality was 2.9% (1/35). One patient (2.9%) developed postoperatively spinal cord ischemia with permanent paraplegia. During follow-up three patients died. All target vessels remained patent excpet for one renal artery. Two patients had a type Ic endoleak and have been planned for a bridging stent-graft extension.

Conclusions: Early outcomes of this preliminary F/BEVAR single center experience seem to be comparable to published outcomes of high-volume centers. A frequent performance of these procedures under a routine protocol may have contributed to these outcomes. Further follow-up is warranted.

Key words: aortic aneurysm; pararenal, thoracoabdominal, endovascular repair; fenestrated, branched.

INTRODUCTION

Fenestrated endovascular aneurysm repair (FEVAR) was first reported in 1999 for the treatment of a juxtarenal aortic aneurysm.[1] Since then the technique has evolved and the number of the included target vessels/fenestrations has been increasing in expert centers aiming to treat more complex pararenal pathologies and to create a longer proximal sealing zone.[2] Following the invention of fenestrations, directional branches were later on introduced to address target vessels with a downward take-off angulation, especially in anatomies where the distance between the aortic stent-graft and the target vessel orifice is longer. Fenestrations and branches can be used in combination to address appropriately target vessels in more extensive thoracoabdominal pathologies. F/BEVAR is increasingly being used to address complex pararenal aortic aneurysms (PAA) and thoracoabdominal aortic aneurysms (TAAA) and real life data show that these techniques have become the first line treatment in many institutions worldwide.[3]

F/BEVAR had been sporadically applied in our institution since 2012 for some selected cases. Since July 2021, a complex endovascular aortic program was initiated aiming to offer systematically F/BEVAR in patients unfit for open repair with unfavorable anatomy for standard EVAR or TEVAR.

This report presents perioperative and early follow-up outcomes of F/BEVAR for PAA and TAAA in a single center.

MATERIALS AND METHODS

All consecutive patients treated with F/BEVAR for PAA or TAAA within the period July 2021 - March 2023, were analysed for this study. Patients with previous failed endovascular or open aortic surgery were also included. All patients signed an informed consent for collection, processing and review of clinical and morphological data.

Main indication for FEVAR included a proximal neck too short for standard EVAR, but otherwise suitable anatomy for EVAR in an AAA of at least 55 mm in diameter. Indication for F/BEVAR in TAAAs, was an aneurysm of at least 60mm in diameter. Details of device design, and procedure execution have been previously described.[3]

Follow-up

Patients were followed with clinical and laboratory examina-

Author for correspondence:

Athanasios Katsargyris, MD, PhD

2nd Department of Vascular Surgery, Laiko Hospital
17 Ag. Thoma Str, 11527, Goudi, Athens, Greece
Tel: +30 6974004441
E-mail: akatsargyris@gmail.com, kthanassos@yahoo.com
doi: 10.59037/hjves.v5i1.13
ISSN 2732-7175 / 2023 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications

tion. Computed Tomography Angiography (CTA) controls were usually performed at 1 month, and 1 year, and thereafter, depending on each patient's characteristics. Upon suspicion of endoleak or branch vessel malperfusion, additional DSA for further evaluation and possible reintervention was carried out.

Data analysis

Statistical analysis was performed using SPSS, version 26.0 (IBM Corp, Armonk, NY). Variables are presented as mean ± standard deviation (SD). Early analyzed outcomes included technical success and 30-day operative mortality. Technical success was defined as successful deployment of the planned stent-grafts with patent stented target vessels and absence of type I or III endoleak at the first postoperative CTA. Early follow-up outcomes included survival, target vessel stent patency, and reintervention rates.

RESULTS

Patient & aneurysm characteristics

During the study period, 35 patients (33 male, mean age 72.6± 7.8 years) were treated. Twenty- one (60.0%) patients were treated for a TAAA and 14 (40.0%) for a PAA. Types of TAAA according to modified Crawford classification were: type II, n=6 (28.6%), type III, n=7 (33.3%) and type IV, n=6 (28.6%). Two patients (9.5%) received F/BEVAR for post-type B dissection TAAA. Patients' co-morbidities and risk factors are listed in Table 1. Fourteen (40.0%) patients had previously undergone one or more open/endovascular aortic procedures. Five (14.3%) patients had an acute aneurysm (2 contained rupture, 3 symptomatic). In four of these patients, an "off-the shelf" 4-branched graft was used (T-Branch, Cook Medical). The fifth patient (symptomatic) was treated with a customised graft as an urgent order. Mean aneurysm diameter was 73.9 ± 9.8 mm.

Table 1. Preoperative patient characteristics

Variable	Patients N (%)
Smoking (current or past)	17 (48.7)
Hypertension	30 (85.7)
Diabetes Mellitus	7 (20.0)
Hypercholesterolemia	13 (37.1)
CAD	18 (51.4)
COPD	18 (51.4)
Serum Cr>100μmol/l	14 (40.0)
PAD	10 (28.6)
Previous aortic surgery	14 (40.0)

CAD; Coronary Artery Disease, PAD; Peripheral Arterial Disease, COPD; Chronic Obstructive Pulmonary Disease.

Stent-graft configuration

All Customised and off-the-shelf grafts used were produced by Cook Medical (William A. Cook Australia, Ltd. Brisbane, Australia). A stent-graft with fenestrations was used in 7 (20%) patients, a stent-graft with branches in 25 (71.4%) patients and a stent-graft with a combination of fenestrations and branches in 3 (8.6%) patients. In two patients an inner branch design (Figure 1) was used

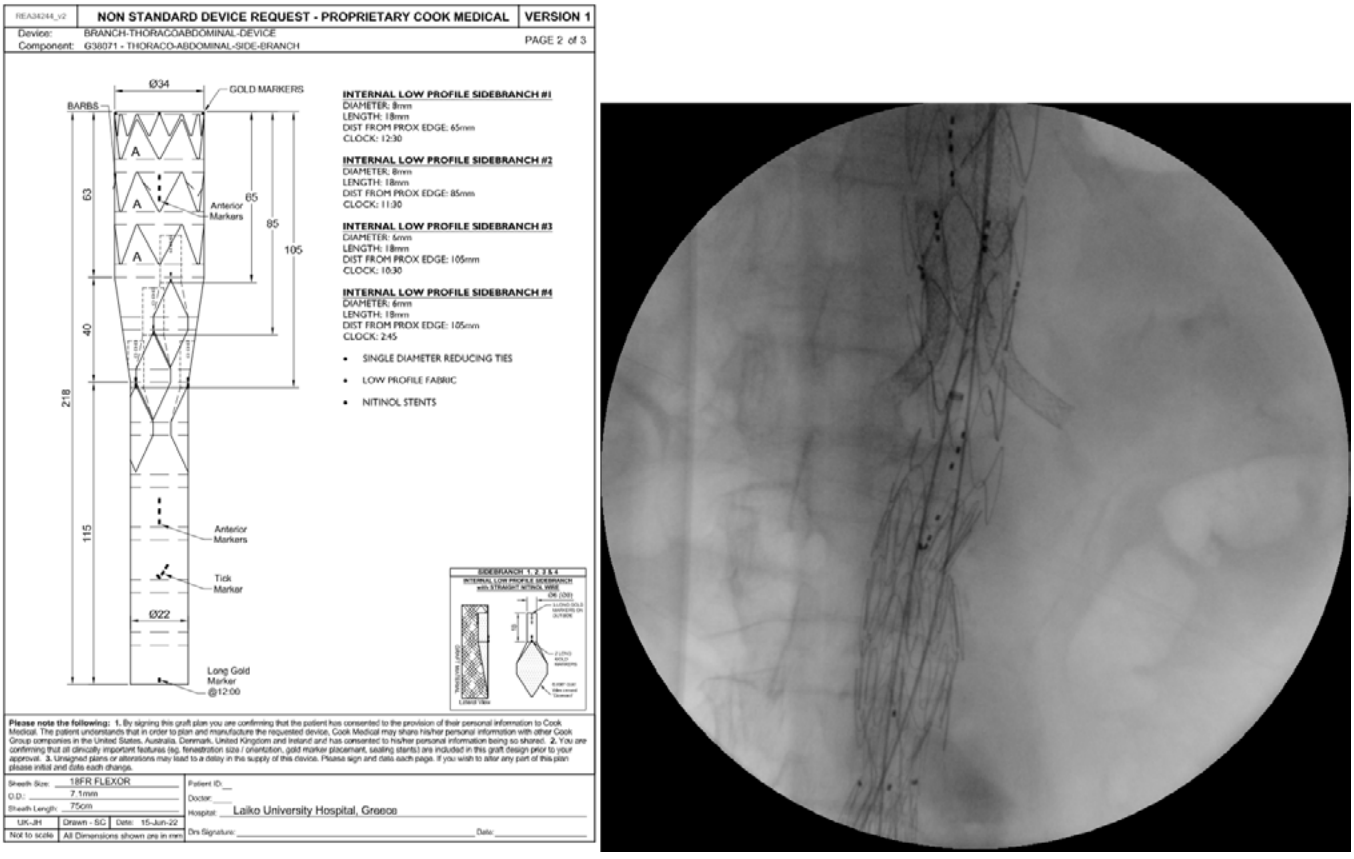

Figure 1: Inner branch configuration to address the limited space between the aortic stent-graft and the aortic wall

instead of the standard directional branches due to limited space between the aortic stent-graft and the aortic wall.[4] A total of 133 vessels were targeted, including 66 renal arteries, 35 superior mesenteric arteries (SMAs) and 32 celiac arteries.

Operative data

Mean operative time was 240 ± 65min with a median estimated blood loss of 200 ml (range, 100-2000 ml). Mean fluoroscopy time was 55 ± 22 min and mean contrast volume used 240 ± 83 ml.

Technical success

Technical success was achieved in 33 (94.3%) patients. Technical failure occurred in 2 patients (5.7%) patients. In one patient with a TAAA one renal artery could not be catheterized and was left unstented. In a second patient with a post-dissection TAAA, one renal artery was dissected and ruptured during catheterization leading to early postoperative death.

Perioperative mortality and morbidity

Thirty-day operative mortality was 2.9% (1/35). One patient suffered intraoperatively a renal artery rupture as mentioned above, which led to severe blood loss requiring acute nephrectomy and died one day after the procedure. One patient (2.9%) suffered massive embolization with buttock necrosis and spinal cord ischemia with permanent paraplegia.

Follow-up outcomes

During follow-up three patients died. One patient had undergone an emergency BEVAR procedure for a contained rupture after failed EVAR, but died of a second rupture 18 months after the BEVAR procedure due to a distal type Ib endoleak from the old EVAR iliac limb. The second patient had a prolonged postoperative course with paraplegia (mentioned above) and died finally of lung infection complications. The third patient died 5 weeks after discharge from the hospital due to COVID infection.

There was one renal artery occlusion during follow-up. Two patients had a type Ic endoleak, both from the celiac artery branch and have been planned for a bridging stent-graft extension.

DISCUSSION

F/BEVAR is being increasingly used to treat complex pararenal and thoracoabdominal aortic aneurysms. Initially FEVAR was introduced for high-risk patients, but later on was offered as a first line treatment also for low-surgical risk patients in specialised centers.[3,5] The latest ESVS AAA guidelines of 2019 stated that in juxtarenal AAA, FEVAR should be considered the preferred treatment option when feasible.[6] Moreover, real life registry data show that F/BEVAR represents also the most commonly used treatment for most TAAAs.[7]

The preliminary F/BEVAR outcomes reported in this series compare well with outcomes published by high-volume European or US expert centers. Technical success rates are in line with other published literature, even though a large proportion (40%) of the included cases were redo procedures after previous endovascular or open aortic repair. Operative mortality was below 3%. Paraplegia rates were also acceptable, given the extensive coverage of the aorta in a large proportion of the patients. Nevertheless a word of caution is required here, given that the patient that developped paraplegia did not have a very extensive aortic coverage (coverage from the mid-to distal part of the thoracic aorta to the common iliac arteries). This patient had a “shaggy aorta” that probalby led to severe embolisation during catheter and wire manipulations that may have resulted to paraplegia. “Shaggy aorta” has been indeed recognised recently as an important risk factor for spinal cord ischemia development after BEVAR.[8]

One patient died 18 months after the BEVAR procedure after suffering a second rupture due to distal type Ib endoleak. This patient had initially an EVAR procedure in another institution that failed proximally after 10 years and led to a type Ia endoleak and rupture. The BEVAR procedure addressed the proximal problem sufficienlty, but the patient finally died due to failure of the distal part of the intial EVAR graft, highlighting the need for a complete repair (relining) in these cases whenever possible in order to avoid distal failures as seen in this patient.

Despite their minimal invasive nature, F/BEVAR procedures are still major undertakings, that can be associated with significant perioperative mortality and morbidity. A multicenter french study reported very high mortality rates of >9% after FEVAR showing that these procedures may not be so benign.[9] The high mortality rates after FEVAR in this study were worrying and suggested that there may be concerns about generalizability within less experienced centres. Indeed, in this study a total of 59 FEVAR procedures were performed over a 10 year period leading to an annual case load of <6 cases per year. Similalry another french multicenter Registry (WINDOWS) reported outcomes in 268 patients who received FEVAR or BEVAR for juxtarenal AAA (group 1), suprarenal AAA and TAAA Type IV (group 2), and TAAA Type I, II, III (group 3). In-hospital mortality was 6.5% for group 1 patients, 14.3% for group 2, and 21.4% for group 3. These increased mortality rates were again associated with participation of less experienced centers in the study.[10]

The results reported in the present series should be interpreted with caution and they may not be reproducible by other centers in their early experience. In our center, all procedures were perfomed with participation of a surgeon with dedicated training in F/BEVAR over a 10-year period. Moreover, since the beginning of the complex endovascular program in our instiution, there has been a continous flow of complex endovascular cases, contributing to the development of a “routine” workflow for the whole personel that is invloved in these procedures with important implications for patient safety.

CONCLUSIONS

Preliminary outcomes of F/BEVAR in this single center series are in line with published outcomes of high-volume expert centers. Perfomance of these procedures by surgeons with

dedicated training in F/BEVAR, along with frequent execution of these procedures appear to contribute to safe patient outcomes, calling for centralisation of these operations.

CONFLICT OF INTEREST STATEMENT

Athanasios Katsargyris has received speaker fees from Cook Inc., & W.L. Gore & Associates, and is a consultant for Bentley Innomed.

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Lessons learned from a case of complicated type II endoleak: when endograft explantation is the only solution

Giovanni Mastrangelo[1,2], Federico Pascucci[1,3], Giancarlo Palena[1], Vincenzo Sciannelli[1], Gabriele Magistro[1], Roberto Marinucci[1], Luigi Semerano[1], Vincenzo Palazzo[1]

[1] Unit of Vascular Surgery, Fondazione IRCCS Casa Sollievo della Sofferenza, San Giovanni Rotondo (FG), 71013, Italy
[2] Department of Innovative Technologies in Medicine & Dentistry, University "G. d'Annunzio" Chieti-Pescara, 66100 Chieti, Italy
[3] Vascular Surgery Residency Program, Fondazione Policlinico Universitario Gemelli IRCCS-Università Cattolica del Sacro Cuore, Largo Agostino Gemelli, 8, 00168 Rome, Italy.

Abstract:

We report the case of a 69-year-old man with a computed tomography angiography (CTA) scan showing an abdominal aortic aneurysm with a bifurcated endograft and a type II endoleak. Our first strategy was the embolization of the inferior mesenteric artery with coils, via superior mesenteric artery and marginal colic artery; then we made another endovascular attempt to reach the T2EL with the transarterial technique but without success. After a multisciplinary consultation, we decided to resort to open conversion. Sacotomy revealed that the aneurysm was being supplied posteriorly, from the infrarenal sealing zone of the endograft (unknown type IA endoleak). Thus, we removed the stent-graft and performed an aorto-bifemoral bypass surgery. From this case we learned two lessons: all possible causes of relapsing and complicated type II endoleak should be investigated (also with CEUS or MRI), and open repair surgery (including endograft explantation) should not be considered only as a last resort in patients fit for surgery.

Keywords: Type II endoleak, open conversion; sac growth, embolization, EVAR.

INTRODUCTION

With the introduction of the endovascular aortic repair (EVAR) procedure, the treatment of abdominal aortic aneurysm has deeply changed in the last 30 years[1]. However, EVAR has recently been shown to be associated with higher rates of long-term complications and need for reintervention[2]. Most of these reinterventions are due to endoleaks (EL) which occur in up to 20% of all EVAR procedures[3]. The type II endoleak (T2EL) represents one of the most common complications. In this case report, we describe all the techniques that we applied in our center to treat a complicated T2EL.

CASE REPORT

We report the case of a 69-year-old man with a history of hypertension and EVAR, performed in another Hospital two years before with a bifurcated Excluder abdominal aortic endoprosthesis (GW.L. Gore & Associates, Flagstaff, Ariz) for an abdominal aortic aneurysm. Computed tomography angiography showed an increased aneurysm sac diameter, from 48 mm at the last CTA in 2019 to 54 mm, and a suspected T2EL from the inferior mesenteric artery (IMA) . Our first strategy was the embolization of the IMA : with a 6 F Simmond catheter, through a left femoral access, we reached the superior mesenteric artery ostium and, on a 0.014" hydrophilic guidewire (Avigo, Medtronic Inc, Swinnea), via the superior mesenteric artery, the middle colic and the marginal artery of the colon (of Drummonds), using a pre-shaped microcatheter (145-5091-150 Echelon 10) we embolized the first segment of the IMA with coils (Axium coils, diameters from 8 to 3.5 mm) (fig.1). We decided to limit our intervention to IMA embolization. Three months after, the CTA showed that the IMA was successfully embolized, but it also showed a slight increase of the aneurysmal left iliac-aortic sac (59 mm diameter), with an increasing lumbar arteries (LA) type II endoleak. Thus, we decided to use a second endovascular approach: from a right femoral access, via transiliac paraendograft[4] we attempted to make the endoleak embolization, but without success because of the complete adhesion of the limb to the iliac wall. In addition, we tried to embolize the culprit LA through the catheterization of the internal iliac and iliolumbar arteries, but the anastomosis webs were too small to be navigated. After three months we found an evident posterior type II endoleak (66mm x 60 mm new sac diameter). Together with the general surgeon and the interventional radiologist, we decided to convert to open repair through midline laparotomy, surgical ligation of extra-aneurysmal backbleeders, sacotomy via a longitudinal aortotomy, endoaneurysmorrhaphy, and stent-graft preservation. After sacotomy, we discovered that the aneurysm sac was being supplied posteriorly, from the infrarenal sealing zone of the endograft. Proximal and distal control was obtained by cross-clamping the aorta and the iliac arteries.

Author for correspondence:

Giovanni Mastrangelo

n°23, Contrada Piano strada n°5, San Giovanni Rotondo (FG), 71013, Italy
E-mail: giovanni.mastrangelo.86@gmail.com
doi: 10.59037/hjves.v5i1.34
ISSN 2732-7175 / 2023 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications

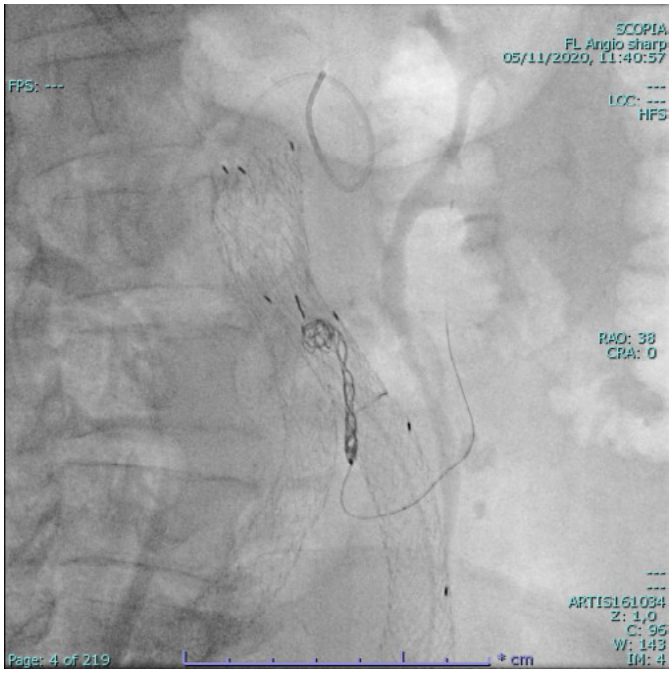

Fig.1: Embolization of the superior mesenteric artery with coils (Axium coils, diameters from 8 to 3.5 mm): on a 0.014" hydrophilic guidewire (Avigo, Medtronic Inc, Swinnea), via the superior mesenteric artery, the middle colic and the marginal artery of the colon (of Drummonds), using a pre-shaped microcatheter (Echelon 10).

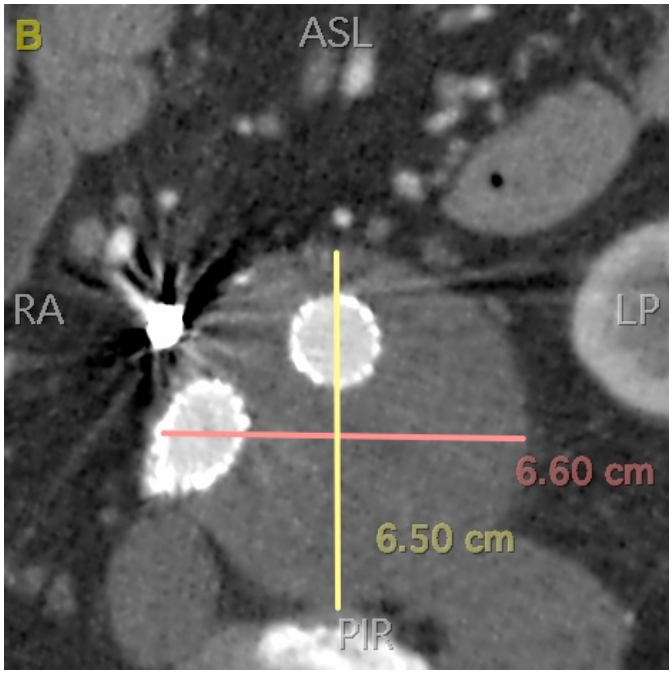

Fig.2: During sacotomy, previously unknown posterior blood flow from the infrarenal sealing zone of the endograft required the endoprosthesis explantation.

Finally, we removed the stent-graft (fig.2) and performed an aorto-bifemoral bypass procedure. Then the patient was sent to the Intensive Care Unit for 72 hours and discharged at the 8th post-operative day with the single anti-aggregation therapy. The 1-month-follow-up CTA showed that the endoleak had been successfully corrected by surgery and that the graft had a good patency, also confirmed by the 6-month-follow-up US scan (fig.3).

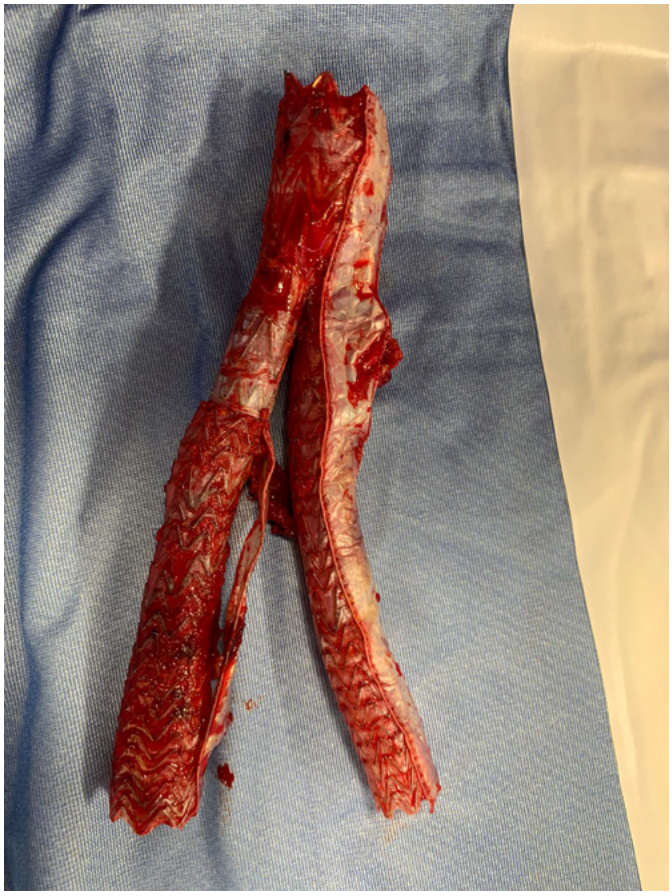

Fig.3: 1-month-follow-up CTA showing a good result of the surgical correction of the endoleak.

DISCUSSION

The 2019 European Society for Vascular and Endovascular Surgery (ESVS) guidelines reported that an expansion of sac diameter of at least 1 cm (a significant growth), detected during the follow-up after endovascular abdominal aortic aneurysm repair using the imaging modality and the measurement method, should be considered for the treatment. A recent systematic review has shown that T2EL after EVAR has a pooled prevalence of 22%, with a reintervention rate of 19%[5]. In addition, EVAR has been reported[6] to be associated with the following features: 1. after EVAR the access to the IMA or LA may be limited; and 2. the recurrence rate of T2EL after an endovascular treatment ranges from 25-80%.

A wide range of treatment options exist, including transarterial embolization, percutaneous direct sac puncture embolization, transcaval embolization, conservative and surgical management[7]. The failure of conservative and endovascular strategies for the treatment of a persistently enlarging T2EL-associated aneurysm is rare, but it requires a surgical approach (tab.1). One of these could be laparoscopy: it remains a technically challenging procedure because of the inflam-

Table 1: Literature review

Study	Type of study
Ken Min Chin et al. Preservation of Stent Graft after Iatrogenic Type III Endoleak during Open Transperitoneal Surgical Intervention for Complicated Type II Endoleak J Vasc Surg 2020;62:496.e1-496.e7.	Case-report
Pierre Maitrias et al. Treatment of sac expansion after endovascular aneurysm repair with obliterating endoaneurysmorrhaphy and stent graft preservation. J Vasc Surg 2016;63:902-8.	Observational study
Madigan MC et al. Occult type I or III endoleaks are a common cause of failure of type II endoleak treatment after endovascular aortic repair. J Vasc Surg 2016;63:9S.	Retrospective study
Aziz A, et al. Outcomes of percutaneous endovascular intervention for type II endoleak with aneurysm expansion. J Vasc Surg 2012;55: 1263e7.	Retrospective study

mation of the sac after EVAR. This strategy is not frequently applied because it is possible in few and selected centers where there are specifically trained vascular surgeons (often in collaboration with specifically trained general surgeons)[8,9]. Another approach is the obliterating endoaneurysmorrhaphy with in situ preservation of the endograft, which was our first plan for the open surgery solution. Furthermore, since some studies[8,10] have reported that some relapsing T2ELs were associated with a different type of endoleak which was missed on the preoperative CTA and since, as we report in tab.1, patients with an occult endoleak may be particularly difficult to manage with the endovascular therapy, we believe an earlier consideration of open surgery (graft explantation included) for patients with an acceptable surgical risk should be advisable. The lessons that we learned with this challenging case of a patient fit for surgery are that: 1. all possible causes of relapsing and complicated type II endoleak should be investigated (also with CEUS or MRI); 2. open surgery represents a good strategy to treat a persistent and relapsing T2EL with an enlarging aneurysm sac. The circumstances which cause the occult endoleak to develop are still unclear. [10]

CONCLUSION

The technical success of open repair surgery on our fit-for-surgery patient confirms that this strategy could be a solution in relapsing and complicated T2ELs. The open surgery strategy should be taken into consideration also for persistent T2EL because it may hide other types of endoleak. Other investigators[10] have recommended the use of alternative diagnostic modalities, such as contrasted-enhanced ultrasound imaging (which should only be performed by experienced angiologists) combined with CTA or pooled magnetic resonance imaging, as effective supporting tools in the detection of occult endoleaks.

ACKNOWLEDGEMENTS

We would like to thank Chiara Di Giorgio (Fondazione IRCCS Casa Sollievo della Sofferenza) for editing and reviewing this manuscript for English language.

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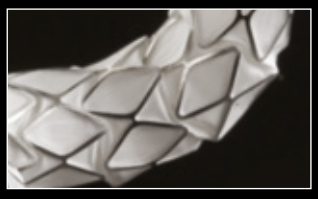

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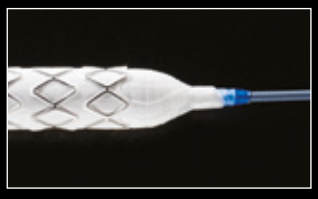

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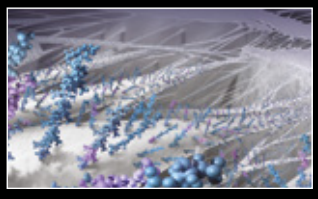

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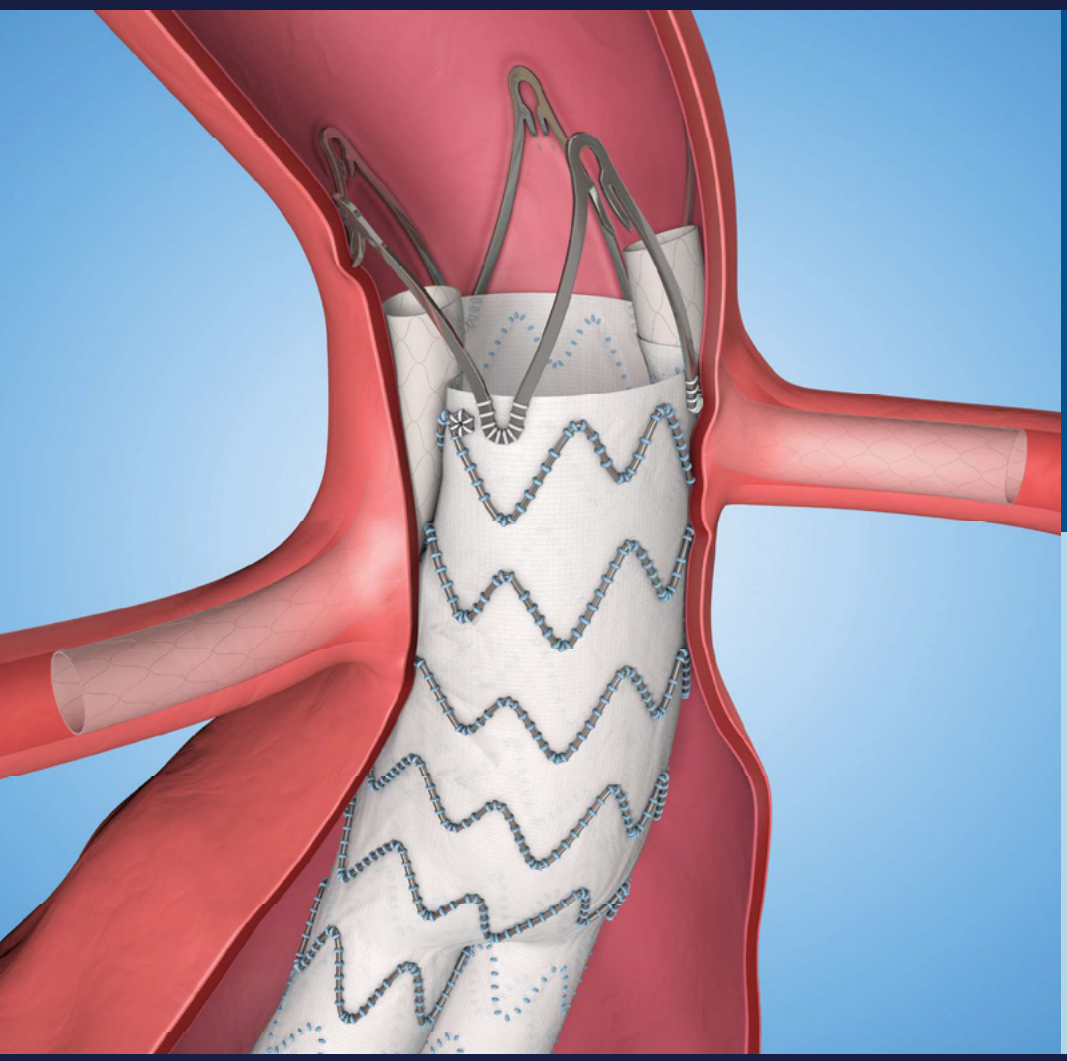

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Ruptured aneurysm of left colic artery: A case report

Chaveles A.[1], Anastasiadou Ch.[1], Maltezos K.[1], Pachi A.[1], Tzortzis D.[2], Doukogianni I.[1], Papapetrou A.[1], Kerasidis S.[1], Papacharalampous G.[1], Maltezos Ch.[1]

[1] Department of Vascular Surgery, KAT General Hospital, Athens, Greece
[2] Department of Interventional Radiology, KAT General Hospital, Athens, Greece

Abstract:

Visceral artery aneurysms belong among the rarest aneurysms, while only few cases of left colic artery aneurysms have been described. We present a case of a ruptured aneurysm of left colic artery in a 52 year old woman. The patient was managed successfully by endovascular means. The post operative course was uneventful and the patient was discharged from the hospital on the 7th postoperative day.

CASE REPORT

A 52 year old female patient with medical history of hypothyroidism and tobacco abuse (60 pack years) presented to the emergency department of another hospital complaining about hypogastric - left lower quadrant abdominal pain. Blood tests, arterial blood gas analysis, abdominal and transvaginal ultrasound were normal. The patient was admitted and treated with intravenous antibiotics (ceftriaxone, ciprofloxacin, metronidazole) like an intra-abdominal inflammation, and symptoms were relieved after 48 hours. On the 3rd day of hospitalization, the patient had acute hypogastric - left lumbar abdominal pain and an episode of orthostatic hypotension. At the same time, a complete blood count showed a drop in hemoglobin / hematocrit (Hgb 9.5 g/dL ,Hct 28.4%) with no hemodynamic changes in the status of the patient. Clinical examination revealed pain elicited by palpation of the left lumbar region with a palpable mass and positive Blumberg sign. A Computed Tomography Angiography (CTA) was performed revealing a ruptured left colic artery aneurysm (maximum diameter = 1.1 cm) with a retroperitoneal hematoma (8.3 cm x 7 cm) (Fig. 1 and 2). The patient was hemodynamically stable and was transferred to our hospital where she underwent angiography. Percutaneous access from the right common femoral artery was gained under local anesthesia and selective cannulation of the inferior mesenteric artery first and then of the left colic artery was achieved with a vertebral catheter. Diagnostic angiography confirmed the presence of an aneurysm of the left colic artery (Fig. 3). Embolization of the aneurysm sac was achieved with multiple microcoils (Hilal Embolization Microcoils 18S- 4.0 cm - 6 mm - COOK MEDICAL) (Fig. 4). Additionally, embolization of the left colic artery proximal to the aneurysm sac was performed with the same pushable microcoils (Fig. 5). Postoperatively the patient was transferred to the ward for further treatment. Over the following day, complete blood count showed elevation of white blood cells (WBC 18,300, Neu 82%) and further drop in hemoglobin / hematocrit (HgB 8.7 g/dL, Hct 27%), whereas physical examination of the patient revealed persistent hypogastric abdominal pain. Arterial Blood Gas test showed no abnormalities (normal range of pH and lactate). Contrast-enhanced abdominal computed tomography scan was performed and showed a slight increase in the dimensions of the retroperitoneal hematoma (9.5 cm x 7 cm) with no active extravasation. No signs of colonic ischemia were found. The patient was treated conservatively with intravenous antibiotics (piperacillin/tazobactam, metronidazole) and fluids , with gradual relief of symptoms. She was discharged from our department on the 7th postoperative day. Abdominal computed tomography after 6 months showed decrease of the dimensions of the retroperitoneal hematoma (3.8 cm x 4 cm) while the patient remained free of symptoms.

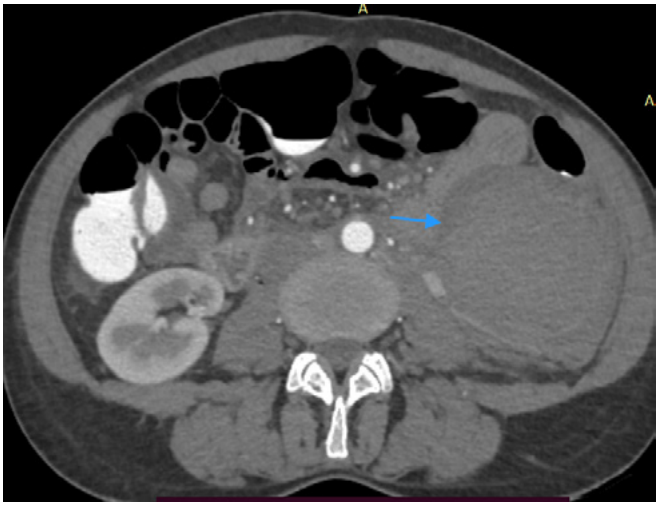

Fig 1: Computed Tomography Angiography showing large retroperitoneal hematoma (8.3 cm x 7cm)

Author for correspondence:

Apostolos Chaveles

Department of Vascular Surgery, KAT General Hospital, 2 Nikis Street, Kifisia, 14561, Athens, Greece
E-mail: chaveles.apostolos@gmail.com
doi: 10.59037/hjves.v5i1.29
ISSN 2732-7175 / 2023 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications

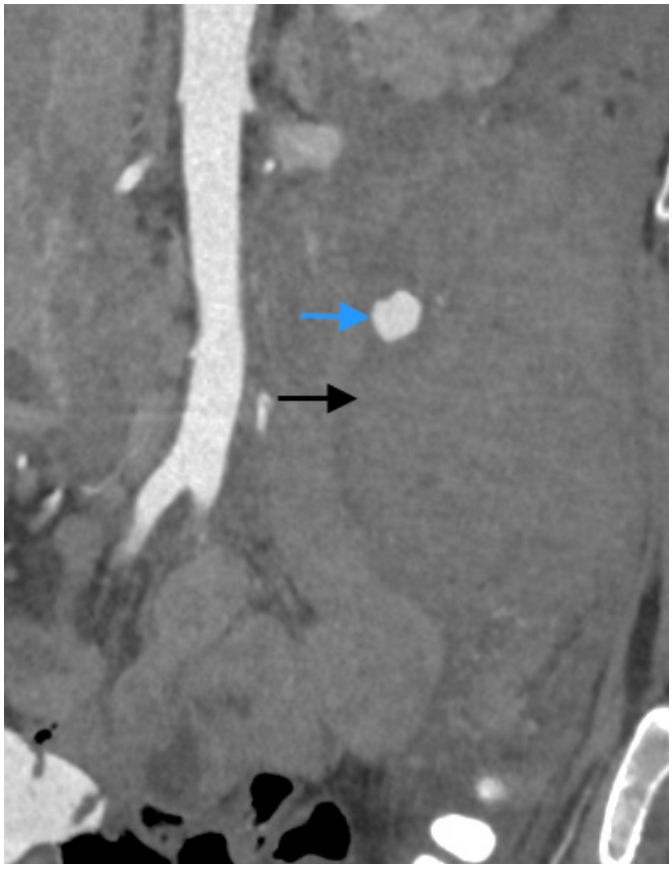

Fig 2. Computed Tomography Angiography in coronal view showing: a) black arrow: retroperitoneal hematoma and b) blue arrow: left colic artery aneurysm

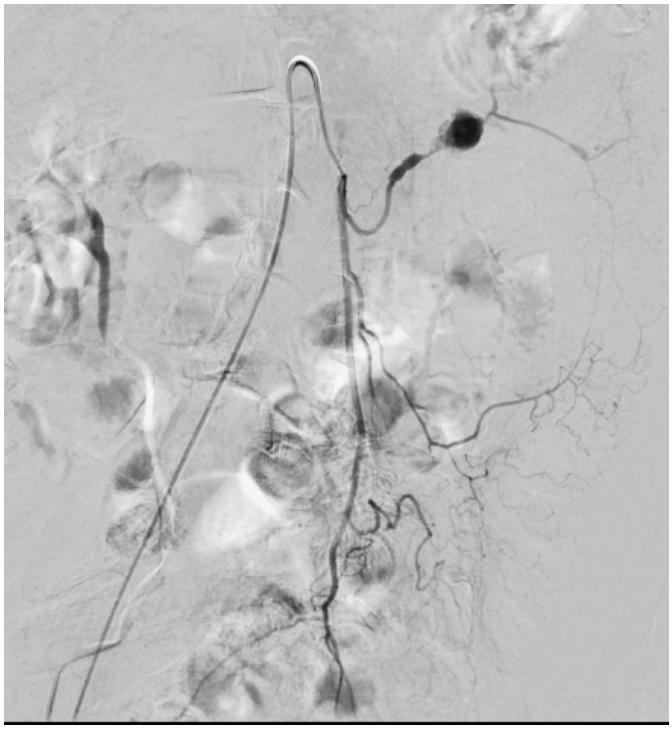

Fig 3. Digital Subtraction Angiography (DSA) showing a left colic artery aneurysm

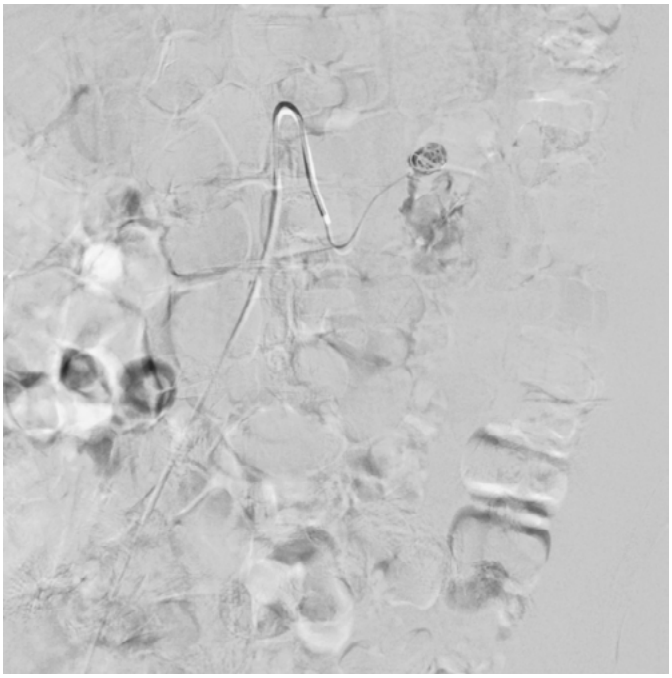

Fig 4. Digital Subtraction Angiography (DSA) showing embolization with microcoils of the aneurysmal sac of the left colic artery

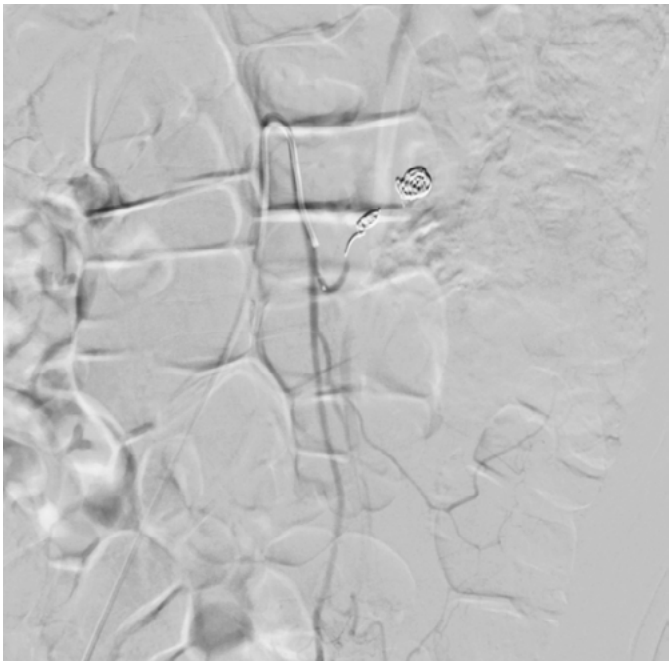

Fig 5. Digital Subtraction Angiography (DSA) showing embolization of the aneurysmal sac and the left colic artery

DISCUSSION

Visceral aneurysms belong among the rarest aneurysms with an incidence of 0.2-2% in the general population.[1-4] Splenic and hepatic aneurysms are the most common visceral aneurysms while inferior mesenteric artery aneurysms and its branches are extremely rare and account for less than 1% of all splanchnic aneurysms.[5] Only a few cases of left colic artery aneurysm have been described in the literature. The pathogenesis of these aneurysms is not well understood, although

various causes of splanchnic aneurysms have been proposed, including atherosclerosis, medial degeneration, collagen diseases (Ehlers-Danlos syndrome), vasculitis (Takayasu, Polyarteritis nodosa) fibromuscular dysplasia and autoimmune disorders.[6,7] A male predominance of 5:1 has been reported.[8] Most of the cases remain asymptomatic and the aneurysm is randomly discovered during an investigation for another abdominal pathology. Some cases, however, have presented in the emergency department with rupture as a medical emergency, with abdominal pain and hypovolemic shock. In these cases, mortality seems to be 20%[9] although it has been reported that in urgent surgery mortality can be increased up to 70%.[10] Diagnosis is often made with computed tomography angiography (CTA) while other imaging techniques such as Magnetic Resonance Angiography (MRA), Digital Subtraction Angiography (DSA) or even ultrasound could be used.[11] Latest guidelines report that mesenteric branch artery aneurysms should be treated regardless of size.[12-14] In the past, open surgery with resection of the aneurysm with or without bypass procedure was the treatment of choice for these entities. Nowadays, endovascular techniques have been described for the treatment of visceral aneurysms, including the use of stent grafts, coil and N-butyl-2-cyanoacrylate (n-BCA) acrylic glue. Given the fact that only few cases of aneurysms of the mesenteric artery branches have been reported, there are no large studies comparing the results and the most appropriate treatment. However, various case reports have showed great results with endovascular treatment, instead of the classic open surgery, minimizing mortality, morbidity and the duration of hospitalization of the patients and should be the considered as the treatment of choice.

CONCLUSION

Inferior mesenteric artery aneurysms and mesenteric branches artery aneurysms are rare entities. Any encountered lesion should be treated regardless of size. There are no large studies indicating the treatment of choice although latest results have showed that endovascular treatment should be considered as the first line of treatment for these patients even if rupture has occurred.

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Angioleiomyoma, A Rare Vascular Tumor

George A. Mprikos, MD, MSc, Petros K. Chatzigakis, MD, MSc, PhD, Vasilios G. Mpouris, MD, MSc, Georgios C. Kopadis, MD, MSc, PhD

Vascular Surgery Department "G. Gennimatas", Athens General Hospital

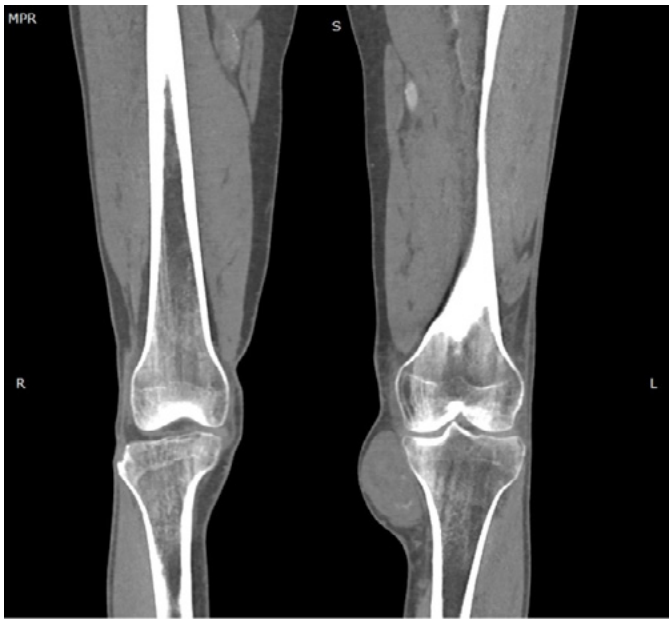

Figure 1.

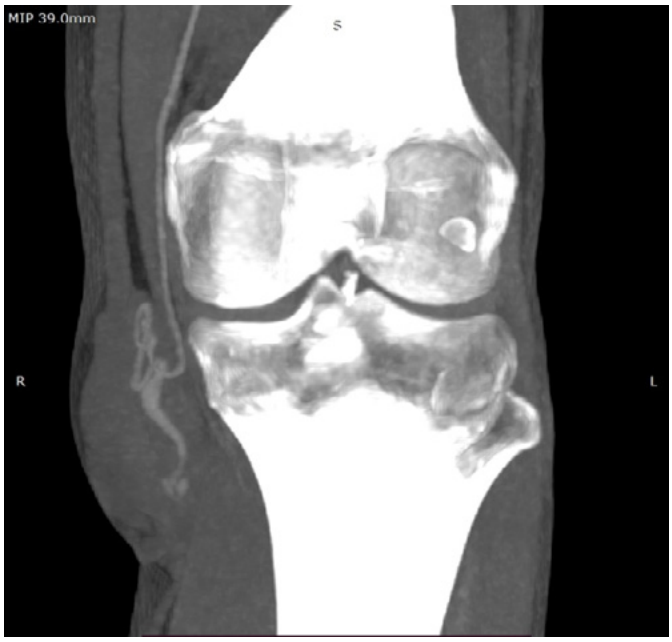

Figure 2.

A 77-year-old male with a known history of benign prostatic hyperplasia was admitted to the Department of Vascular Surgery with a mass located on the inner surface of the left calf. The patient did not report any history of injury. The mass had become clinically visible five years ago.

A Computed Tomography Angiography was performed revealing a confluence of inflated arterial branches that appeared to communicate with the left superficial femoral artery. During the late arterial phase distended venous elements were identified communicating with the left great saphenous vein, which showed similar enrichment to the adjacent arteries.

Differential Diagnosis included great saphenous vein injury, pseudoaneurysm and arteriovenous malformation.

Under general anesthesia, the mass was fully excised. Ligation of arterial branches, part of the greater saphenous vein and venous trunks were performed. No adhesions with surrounding tissues were found.

Biopsy of the mass showed morphologic and immunohistochemical features compatible with myopericytoma or angioleiomyoma with the latter being considered more likely. Excision of the neoplasm was assessed as complete.

Postoperative course was uneventful and the patient was discharged after two days. An oncology consultation was performed and an imaging follow-up was scheduled in six months.

Author for correspondence:

Georgios A. Mprikos

Department of Vascular Surgery, "G. Gennimatas" Athens General Hospital, Mesogeion 154, 15669, Athens, Greece
E-mail: gbrikos.1091@yahoo.gr
doi: 10.59037/hjves.v5i1.33
ISSN 2732-7175 / 2023 Hellenic Society of Vascular and Endovascular Surgery Published by Rotonda Publications

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Selected abstracts from the Aortic Surgery Peripheral & Venous "How to do it", Milano December 15th-17th, 2022

BALLOON INDUCTED RE-LAMINATION AND FALSE LUMEN THROMBOSIS (BAILOUT) IN CHRONIC TYPE B AORTIC DISSECTION: TECHNIQUE AND LONG-TERM RESULTS

Francesco Andreoli ,MD; Stefano Gennai, MD; Nicola Leone, MD; Luigi Alberto Maria Bartolotti, MD; Tea Covic, MD and Roberto Silingardi MD

Vascular Surgery Unit, Ospedale civile di Baggiovara (OCB)-Azienda Ospedaliero-Universitaria (AOU) di Modena, Università di Modena e Reggio Emilia, Baggiovara (Modena), Italy

Introduction and Objective: To evaluate the safety, feasibility, and effectiveness of the BAlloon Inducted re-Lamination and false lUmen Thrombosis (BAILOUT) as a simple technique to address the retrograde false lumen (FL) perfusion and subsequent aneurysmatic degeneration of the thoracic aorta due to a stent-graft crimped in a small TL in Chronic Type B dissections.

Methods: Observational, retrospective, single-center study analyzing a non-consecutive cohort of 8 patients affected by chronic type B aortic dissections already treated with TEVAR and with an FL lumen backflow corrected with BAILOUT between 2006 to 2020. After a standard distal extension of the previously implanted graft, the distal end of the graft area was ballooned to completely rupture the dissection lamella to relaminate the aorta hindering the FL backflow. Computed tomography was routinely performed within the first postoperative week before discharge and then at 3 months, at 6 months, and yearly thereafter. The technical and clinical success rates were analyzed. Primary outcomes were safety and feasibility of the technique, secondary ones included FL thrombosis evaluation and total aortic diameter analysis at the above-defined levels during the follow-up. Safety was defined if clinical success was reached. Feasibility was intended as technical success obtaining.

Results: The technical and clinical success achieved was 100% with the complete interruption of FL backflow stating the safety and feasibility of the BAILOUT technique. No early procedure re-interventions were recorded and during a median follow-up of 62.5 months [IQR range 43.2-94.1], only one death unrelated to the procedure was recorded. Freedom from aortic-related adverse events at 1-month, 3-months, 1 year, 5 and 7 years was 87.5%, 62.5%, 62.5%, 62.5% and 62.5% respectively. During the follow-up, no one increment of the diameter of the thoracic aorta was documented and all the patients at 3-years of CTA showed a complete FL thrombosis.

Conclusions The BAILOUT technique demonstrates to be safe and feasible in this small cohort of patients as a simple and quick way to overcome the issue of FL backflow in chronic type B dissection. Small cohort and retrospective designs were limitations of the study.

INTRAOPERATIVE PREDICTORS OF IN-HOSPITAL MORTALITY AFTER OPEN REPAIR OF RUPTURED ABDOMINAL AORTIC ANEURYSMS

[1]Giulia Bertagna, [1]Nicola Troisi, [2]Athanasios Saratzis, [3]Simone Guadagni, [4]Fabrizio Minichilli, [1]Daniele Adami, [1]Mauro Ferrari, [1]Raffaella Berchiolli

[1]Vascular Surgery Unit, Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Italy

[2]Department of Cardiovascular Sciences, University of Leicester, Glenfield Hospital, Leicester, UK

[3]General Surgery Unit, Department of Translational Research and New Technologies in Medicine and Surgery, University of Pisa, Pisa, Italy

[4]Environmental Epidemiology Unit, Institute of Clinical Physiology - National Research Council, Pisa, Italy

BACKGROUND: Several models and scores have been released to predict early mortality in patients undergoing surgery for a ruptured abdominal aortic aneurysm (rAAA). These scores included above all preoperative factors and they could be useful to deny surgical repair. The aim of the study was to evaluate intraoperative predictors of in-hospital mortality in patients undergoing open surgical repair (OSR) for a rAAA.

METHODS: Between January 2007 and December 2020, 265 patients were admitted at our tertiary referral hospital for a rAAA. Two-hundred-twenty-two patients underwent OSR. Intra-operative factors were analyzed by means of univariate analysis (step 1). Associations of procedure variables with in-hospital mortality rates were sought based on a multivariate Cox regression analysis (step 2).

RESULTS: Overall, in-hospital mortality rate was 28.8 % (64 cases). Multivariate Cox regression analysis reported that operation time >240 minutes (P=.032, OR 2.155, CI 95% 1.068-4.349), and hemoperitoneum (P<.001, OR 3.582, CI 95% 1.749-7.335) were negative predictive factors for in-hospital mortality. Patency of at least one hypogastric artery (P=.010; OR .128, CI 95% .271-.609), and infrarenal clamping (P=.001; OR .157, CI 95% .052-.483) had a protective role in reducing in-hospital mortality rate.

CONCLUSIONS: Operation time >240 minutes, and hemoperitoneum affected in-hospital mortality in patients undergoing OSR for rAAA. Patency of at least one hypogastric artery, and infrarenal clamping had a protective role. Further studies are needed to validate these outcomes. A validated predictive model could be useful to help the physicians in communication with patients' relatives.

OUTCOMES OF ILIAC BRANCH ENDOPROSTHESIS IMPLANTATION ASSOCIATED WITH INTENTIONAL OCCLUSION OF INTERNAL ILIAC ARTERY DISTAL BRANCHES

C. Bugna, A. Kahlberg MD, M. Bossi MD, E. Rinaldi MD, D. Mascia MD, G. Melissano MD, R. Chiesa MD
"Vita-Salute" University, Scientific Institute H. San Raffaele, Milan, Italy

Introduction and Objectives*:* Endovascular exclusion of abdominal aorto-iliac aneurysms with Iliac branch endoprostheses (IBE) may require additional embolisation of internal iliac artery (IIA) collateral branches, when distal landing in the IAA is not suitable. The aim of this study is to evaluate the early and late clinical results in this cohort of patients, and to compare them with those submitted to standard IBE implantation.

Methods: This retrospective single-centre study includes patients who underwent elective IBE implantation for abdominal aorto-iliac or isolated iliac aneurysms between 2017 and 2021. Patients were assigned to StG group if submitted to standard IBE implantation (distal landing in the IIA), and to EmbG group if submitted to IBE implantation (distal landing in a IIA branch) associated with single or multiple IIA branch embolisation. Demographics and risk factors, intra and postoperative data at 30 days and at last follow-up (FU, mean 24±19 months), were collected and analysed. Technical success was defined as successful introduction and deployment of the device in the absence of surgical conversion or mortality, type I or type III endoleak, branch occlusion, or graft limb obstruction. Early endpoints were procedure duration, dose area product (DAP), technical success, in-hospital major adverse event (MAE) rate, need of blood transfusion, length of stay (LOS), 30-day branch thrombosis and reintervention rate. Late endpoints were IBE-related endoleak, branch thrombosis, reintervention, and buttock claudication at FU.

Results: A total of 88 patients (84 males; mean age, 73±8 years) were included in this study: 78 patients in the StG (88.6%) and 10 in the EmbG (11.4%). Both groups were homogeneous as regards risk factors and demographics. No significant differences in procedure duration and DAP were observed. The overall technical success rate was 98.7% in the StG and 100% in the EmbG. In-hospital MAE rate [StG, 12.8% vs EmbG, 0%; p=0.596] and need of blood transfusion [StG, 16.7% vs EmbG, 10%; p=1.0] were similar in both groups. LOS resulted lower in the EmbG [StG, 2.91±1.36 days vs EmbG, 1.7±0.95 days; p=0.008]. Thirty-day branch thrombosis [StG, 0 (0%) vs EmbG, 1 (10%); p=0.113] and re-intervention [StG, 0 (0%) vs EmbG, 1 (10%); p=0.113] rates were not significantly different. At FU, endoprosthesis branch thrombosis was observed more frequently in the EmbG group [StG, 0 (0%) vs EmbG, 2 (20%); p=0.011]. No statistically significant difference at FU was found as regards endoleak [StG, 5 (6.4%) vs EmbG, 0 (0%); p=1.0] and reintervention [StG, 2 (2.6%) vs EmbG, 0 (0%); p=1.0] rates. In particular, 2 IBE-related endoleaks requiring reintervention were detected, both in the StG group and due to the loss of sealing on IAA distal landing zone (type IIIc). They were treated by embolisation of a pudendal branch and IBE distal extension. Buttock claudication rate was similar in the two groups [StG, 5.2% vs EmbG, 10%; p=0.461].

Conclusions: According to this single-centre analysis, IBE implantation associated with IIA branches embolisation does not entail significant changes in perioperative outcomes as compared to controls. At follow-up, increased thrombosis of the endoprosthesis iliac branch may be observed, even if they were not associated with higher reintervention rates or buttock claudication. Conversely, standard IBE implantation may be associated with development of type IIIc endoleak at follow-up. Longer assessment and larger cohort studies are needed to confirm these initial observations.

ROLE OF CONTRAST ENHANCED ULTRASOUND IN THE FOLLOW-UP AFTER ENDOVASCULAR ABDOMINAL AORTIC ANEURYSM REPAIR

Federica Maria Castellana, Alessandra Fittipaldi, Domenico Spinelli, Giovanni De Caridi, Daniela Toro, Filippo Benedetto
Department of Biomedical, Dental, Morphological and Functional Imaging Sciences, Policlinico G. Martino, Messina. Italy

Introduction and Objective: Endovascular abdominal aortic aneurysm repair (EVAR) has several advantages over traditional open surgical aneurysm repair, including lower invasivity and shorter hospital stay. However, its main drawback is the need for a life-long follow-up. Clinical practice guidelines regarding the optimal follow-up strategy, suggest Computed Tomography Angiography (CTA) as the best method. Computed Tomography Angiography (CTA) has good accuracy and reproducibility, but it is burdened by high cumulative dose radiation exposure and contrast agent nephrotoxicity, especially if used annually over a long period of time. The aim of this study was to assess whether contrast enhanced ultrasound (CEUS) shows a false negative rate close to zero and therefore is suitable as the main non-invasive follow-up strategy for long-term monitoring after endovascular aortic repair (EVAR).

Methods: We included all consecutive patients who underwent CEUS as follow-up after EVAR at our center between January 2017 and December 2021. The follow-up protocol consisted in Duplex ultrasound (DUS) with CEUS at 1, 3, 6 months post operatively and every 6 months thereafter. All patients underwent computed tomography angiography (CTA) at 1 and 12 months and when indicated by the operator.

Results: A total of 125 patients (male=114, 91%, mean age 74.6±7.3) underwent, in total, 228 CEUS. The aneurysm sac (preoperative mean diameter 56±13mm) showed shrinkage in 80 patients (64%), stability in 32 patients (25.6%), enlargement in 13 patients (10.4%). 29 (23,2%) patients showed type 2 endoleak, 13 patients underwent one or more reinterventions for the following indications: type 1 endoleak (four type 1A, three type 1B, one type 1C), type 3 endoleak (six patients), type 2 endoleak with sac enlargement (five patients). In detecting any endoleak, the sensitivity of CEUS vs DUS was 100% vs 75% (P>0.0001). In classifying type 2 endoleak, CEUS compared to

DUS showed sensitivity 93.2% vs 59.4%, specificity 99.3% vs 99.3%, PPV 98.6% vs 97.7%, NPV 96.8% vs 83.6%. In the detection of type 1 or 3 endoleak, CEUS and DUS did not show any discrepancies. For both techniques, sensitivity was 84,6%, specificity was 100%, PPV was 100% and NPV was 99,1%.

Conclusions: CEUS showed higher sensitivity compared to DUS in the detection of type 2 endoleak. For this reason, it is a valuable tool in the follow-up of patients undergoing EVAR, as it permits the identification of a subset of patients requiring a stricter follow-up protocol.

CONCOMITANT TRANSCATHETER AORTIC VALVE IMPLANTATION AND ENDOVASCULAR AORTIC ANEURYSM REPAIR

F. Cecere, G.Faggioli, E.Gallitto, F.Saia, T.Palmerini, A.Logiacco, R.Pini, A.Bruno, C.Marrozzini, M.Gargiulo
University of Bologna, Policlinico S. Orsola, Malpighi, Bologna, Italy

Introduction and Objective: Transcatheter aortic valve implantation (TAVI) has become the standard treatment for severe aortic valve stenosis in patients with high or intermediate risk. Transfemoral access is the preferred route due to its reduced invasiveness and lower perioperative morbidity and mortality than trans-axillary, aortic and apical routes. Concomitant aortic aneurysms may require associated endovascular treatment with theoretically increased perioperative risks, though literature on the matter is currently lacking. The aim of this study is to report the outcomes of concomitant endovascular abdominal (EVAR) or thoracic (TEVAR) aortic aneurysms repair and TAVI.

Methods: This is a single center observational study. Twelve consecutive cases of concomitant EVAR or TEVAR and TAVI were prospectively collected, and data was retrospectively analyzed by a dedicated study group composed by cardiologists and vascular surgeons. Technical success (TS), mortality, morbidity and reinterventions were assessed as early outcomes within 30 days from the procedure. Readmission, reinterventions and survival were evaluated during follow-up.

Results: From 2017 to 2022(July) 12 cases of concomitant aortic aneurysm repair and TAVI were performed: EVAR - 10 (83%), TEVAR - 2 (17%). The median age and aneurysm diameter were 81(IQR:10) years and 68 (IQR:13) mm, respectively. Patients with ASA III and IV were 10(83%) and 2(17%), respectively. Procedures were performed under local anesthesia in 4 (33%), and general anesthesia in 8 (66%) cases. Surgical femoral access was used in 6(50%) patients, percutaneous access in the other 6(50%). Median procedure and fluoroscopy times were 191(18) and 28(13) minutes, respectively. The median iodinated contrast media administration was 126 (15) mL and in 10 (83%) cases CO2 automated angiography was used. Technical success was achieved in all cases and no patient died within 30 days. The median hospitalization was 5(1) days. There were no postoperative cardiac, pulmonary or neurological complication. There was one case of transient postoperative renal function worsening. No patient required 30-day readmission nor reintervention. The median follow-up was 18 (12) months with no cases of aortic or cardiac related mortality. One patient died on the 45th post-operative day due to COVID-19 infection.

Conclusions: Concomitant T/EVAR and TAVI is safe and effective with excellent technical success and satisfactory early and mid-term clinical outcomes. This combined approach may reduce the perioperative risks and costs compared with sequential procedures.

CHRONIC ORAL ANTICOAGULATION AND CONTEMPORARY OUTCOMES OF ELECTIVE ENDOVASCULAR AORTIC ANEURYSM REPAIR

Lara R Dias[1], Leandro Nóbrega[1], José Oliveira-Pinto[1,2], Armando Mansilha[1,2]
[1] Department of Angiology and Vascular Surgery, Centro Hospitalar São João, Porto, Portugal
[2] Department of Surgery and Physiology, Faculty of Medicine, Porto University, Porto, Portugal

Introduction and Objective: Impact of chronic anticoagulation on endoleak risk after EVAR has been conflicting. Our aim was to assess how anticoagulation at time of EVAR can impact endoleak risk after EVAR.

Methods: A retrospective review of all patients submitted to elective EVAR for infra-renal abdominal aortic aneurysms from January 2018 to December 2021 was performed. Patients with isolated iliac aneurysms, complex repair (F/BEVAR) or presenting with rupture or symptomatic aneurysms were excluded. Patient demographics, procedural and post-operative outcomes were reviewed. Outcomes were defined according the SVS Reporting standards for endovascular aortic aneurysm repair. Primary endpoint was the impact of chronic anticoagulation type II EL after EVAR. Post-operative complications and reinterventions were also addressed. Survival analysis was preferred to compare endoleak occurrence among groups. Cox regression was performed to evaluated independent anticoagulation effect on type II EL occurrence.

Results: A total of 99 patients were identified, with 19 (19.2%) of these on chronic oral anticoagulation at time of EVAR. All anticoagulated patients were male and were older than non-anticoagulated patients (mean age 76.4 ±8.5 vs 71.4 ± 7.9, p=0.017). Patients on oral anticoagulation were more likely to have cardiac arrythmia, with no other differences regarding baseline comorbidities. There were no differences in type of anaesthesia or intra-operative complications. Four patients on anticoagulation were submitted to an additional procedure in the first 30-day (21.1% vs 7.5%, p=0.096). Mean follow-up was 18,9 ± 15,25 months. During follow-up, a total of 10 patients developed type II endoleak (EL): four patients in the anticoagulation group (21,1%), vs 6 non-anticoagulated patients (7,5%), p=0.032). After adjustment for age and gender, anticoagulated patients were at greater risk for type II EL (HR: 8.92, CI95% 1.65-48.12, p=0,011). Three-year overall survival was worst for anticoagulated patients, 49,1% vs 87,7%, p=<0.001 (Fig.1).

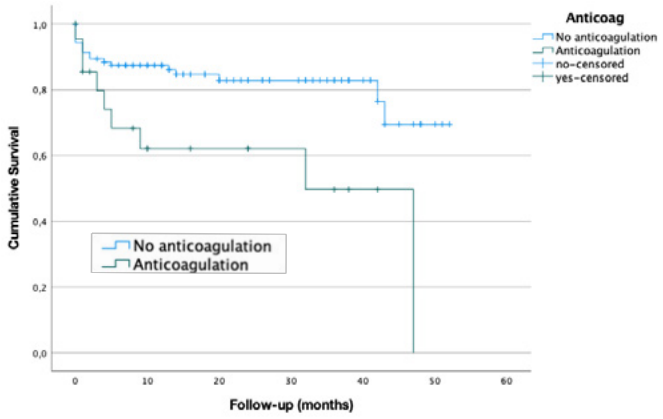

Fig. 1. Kaplan-Meyer survival analysis of anticoagulated patients vs non-anticoagulated patients.

Conclusions: Chronic oral anticoagulation at time of EVAR might bring an increased risk in the development of type 2 endoleak, even after adjusting for age and gender, which did not translate in more reinterventions during follow-up. Survival of anticoagulated patients was worst, which may be related to the underlying cause for anticoagulation or to adverse events of this therapy.

OUTCOME OF CHIMNEY TECHNIQUE IN PATIENTS WITH PARARENAL ANEURYSM ÐITH MURAL AORTIC THROMBUS

Alessandra Fittipaldi, Federica Maria Castellana, Narayana Pipitò, Domenico Squillaci, Filippo Benedetto
Department of Medical Sciences and Morpho-Functional Imaging - University of Messina, Messina, Italy

Introduction and Objective: Endovascular repair (EVAR) is currently the most used treatment option for abdominal aortic aneurysms. Chimney technique can be used to treat patients with urgent pararenal aortic aneurysm unfit for open surgery and not suitable for custom made fenestrated endograft due to production time. Since almost one in five patients undergo a reintervention within three years, features associated with higher risk of complications need to be investigated in order to tailor the follow-up schedule to each patient. The aim of our study was to assess the impact of mural thrombus in the pararenal aorta on perioperative and follow-up complications after Chimney Technique.

Methods: All consecutive patients undergoing Chimney Technique at our center from 2016 to 2022 were included in a retrospective study. Collected variables included number of target vessels, stentgraft size, presence and severity of mural thrombus in pararenal aorta, which was evaluated on pre-operative computed tomography angiography and reported with a scoring system from 0 to 10 based on thrombus type, thickness area and circumference. Outcomes included peri-operative and follow-up complications such as endoleaks, chimney stent complications (including partial or total thrombosis, intrastent stenosis, displacement), renal function worsening and mortality.

Results: A total of thirty-one patients underwent Chimney Technique during the study period. Twenty-seven patients underwent Chimney technique for pararenal abdominal aneurysm instead four patients underwent ChEVAR for a type 1A endoleak after previous endovascular repair. The number of target vessels was 1 in 17 patients (55%), 2 in 12 (39%), 3 in 1 (3%) and 4 in 1 (3%). The mean mural thrombus score was 5.9. Üomplications were the following: type 1A endoleak in 4 cases (13%), chimney stent complications in 7 cases (23%), renal function worsening during follow-up in 8 cases (26%). Of those patients who had chimney stent complications, 2 patients had partial stent thrombosis, 1 patient had total stent thrombosis and 4 patients had stent displacement. Decline of the eGFR during the follow up was mild in 1 patient (89-60 ml/min/1,73 m^2), moderate in 6 patients (59-30 ml/min/1,73 m^2), severe in 1 patient (15-29 ml/min/1,73 m^2). No one of our patients needed renal replacement therapy.Ðverall survival was 90% at two years. Patients with severe mural thrombus showed lower freedom from chimney-related complications (28% vs 59% at two years, p=0.023). No correlations have been found between number of target vessel and post-operative complications.

Conclusions: Our results show that the presence of severe pararenal aortic mural thrombus is associated with complications in patients undergoing Chimney Technique for pararenal aortic aneurysm repair with lower freedom from chimney related complications.

A NEW METHOD OF AORTIC TISSUE DECELLULLARIZATION FOR SCAFFOLDS DEVELOPMENT

Igor Kozin[1,2], Evgenij Petrov[1], Tatiana Kozina[1], Larisa Volova[1], Irina Nefedova[1], Pavel Timchenko[3], Elena Timchenko[3], Roman Skidanov[3], Pavel Zelter[1]
[1]Samara State Medical University, Samara, Russia
[2]Heinrich-Heine-University Düsseldorf, Düsseldorf, Germany
[3]Samara National Research University, Samara, Russia

Introduction and Objective. Decellularized biological scaffolds from vascular tissue can potentially replace artificial vascular conduits, which will help solve the issues of donor vessel shortage and the recipients' immune response. A variety of decellularization techniques have been described and used to achieve effective immunogenic agent removal from a developed vascular scaffold. Although several decellularized vascular grafts are currently on the market, clinical outcomes are still poor due to graft-associated thrombosis, infection, and aneurysm. Given the increasing number of cardiovascular procedures in the world it is necessary to improve existing grafts and look for new methods for scaffolds development.

Methods. Two human thoracic aortas were harvested from cadaveric material and decellularized with 1% formaldehyde and hexane pure for analysis. Hematoxylin-Eosin staining and Raman spectroscopy were used to confirm complete decellularization. The samples were made electron-conductive and were investigated with electron microscopy to evaluate the structure of the aortic grafts. For an *in vivo* experiment two grafts from human saphenous veins were decellularized

using the same protocol. Afterwards they were implanted in two Flemish Giant rabbits in the abdominal aorta position with "end-to-side" anastomoses. After surgeries the rabbits received food and water *ad libitum.* A grafts patency was assessed with contrast computer tomography (CT) and ultrasound method. A Doppler ultrasound was used to measure velocity characteristics of blood flow through the conduits. On days 14 and 28 grafts were harvested and embedded in paraffin. Hematoxylin-eosin staining and light microscopy were used to estimate cell repopulation of decellularized implants.

Results. Hematoxylin-eosin staining of the aortas after decellularization demonstrated a complete elimination of cell nuclei. Analysis of the Raman spectra revealed a decrease in the intensity peak specific for deoxyribonucleic acid (DNA) in the decellularized aortas. On the electron microscopic images preserved aortic extracellular matrix with elastic lamellae is observed. All animals survived after surgeries. CT and ultrasound showed good patency of the grafts without signs of stenosis and thrombosis. The mean peak systolic velocity in the first third of the conduits was 122±13 cm/sec and the blood flow rate - 100±3 ml/min. After the 14th and 28th days of implantation we observed cell recellularization of the decellularized extracellular matrix and the formation of neointima on the histological images. At the 14th day the infiltration of immune cells outside of the graft persisted and at the 25th day no prolonged inflammation was observed.

Conclusions. A new method of aortic implants decellularization with formaldehyde and hexane application makes it possible to achieve a complete elimination of cellular and nuclear contents. The small animal model demonstrated the adequate patency of the grafts, consistent cell repopulation of the extracellular matrix and absence of the hyperinflammatory immune response in a short-term period. Further investigations are required, like quantitative determination of residual DNA within the grafts after decellularization, immunohistochemistry for phenotyping of cells repopulating decellularized material after implantation.

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HIGH PREVALENCE OF THORACIC AORTIC DISEASE IN PATIENTS WITH CONTEMPORARY LUNG CANCER: AN OBSERVATIONAL STUDY.

Elisa Lazzeri, Gianmarco de Donato, Edoardo Pasqui, Giulia Casilli, Mustafa Abu Leil, Eleonora Cerbini, Giuseppe Galzerano, Giancarlo Palasciano
University of Siena, Dipartimento di scienze mediche,chirurgiche e neuroscienze, Siena, Italy

Introduction and Objective: Lung cancer and thoracic aortic disease, including aortic aneurysm and dissections, intramural hematoma and penetrating aortic ulcer (PAU), share multiple risk factors. This study aims to investigate the contemporary prevalence of these two conditions.

Methods: This was a single-centre, retrospective, observational study. All patients who underwent thoracic surgery for contemporary lung cancer between October 2019 and June 2021 were considered eligible to be part of this study. Demographic and risk factor data were obtained, and patients' tomography-computed angiography scans were used to investigate the whole aorta. Multilinear regression modeling was used to evaluate the independent associations of multiple variables on the presence of thoracic aortic disease.

Results: Among 264 patients who underwent thoracic surgery, only 148 had primary lung cancer. Of them, 62% were male and the mean age was 71 +/- 8.7. The main histotype was adenocarcinomas (70%), followed by squamous cell carcinoma (20%), small cell carcinoma (3%) and other types (7%). Smoker people were more than nonsmokers (79%). Of these patients, 27% have already undergone vascular surgery. Angio-CTs showed that ascending aorta medium diameter was 35mm+/- 4,9mm, the arch medium diameter was 26mm +/- 3,2 mm and the thoracic aorta medium diameter was 27mm +/- 3,75mm. The prevalence of thoracic aorta aneurysm in the cohort was 12%, penetrating aortic ulcer was 10%, thoracic aortic dissection was 2% and intramural hematoma 1.35%.

Conclusions: In our experience lung cancer and thoracic aortic disease share similar risk factors and patients with lung cancer who approach surgery have a high rate of incidence of vascular diseases. In the future, a significant reduction of CT radiation exposure may be obtained by the simultaneous screening for both pathologies. Furthermore, it could allow an earlier diagnosis of thoracic aortic disease in populations of patients that are not routinely screened for, such as women.

RESULTS AFTER INNOMINATE ARTERY GRAFTING

Dmitriy Polyansky , Zaurbek Adyrkhaev, Dmitriy Beloyartsev
A.V. Vishnevsky National Medical Research Center of Surgery, Moscow, Russia

Introduction and Objective. Atherosclerotic lesion of the innominate artery (brachiocephalic trunk) in patients with cerebrovascular diseases occurs in 0.5-2% of cases and causes cerebral and upper limb ischemia. Today, most specialists perform innominate artery grafting for such lesions, which has proven to be an intervention providing long-term patency and

freedom from neurological deficits.

Objective: to evaluate the results of innominate artery grafting in atherosclerotic lesions.

Materials and Methods. The results of 79 intrathoracic reconstructions performed for hemodynamically significant atherosclerotic lesions of the brachiocephalic trunk at the A.V. Vishnevsky National Medical Research Center of Surgery were analyzed from 1983 to 2020. Long-term results were studied in 65 (82%) patients out of 79. The average follow-up was 143.4±33.1 months (about 12 years), maximum was 455 months (almost 38 years).

Results. In the majority of cases linear innominate artery grafting was performed - 52 (65,8%), in the remaining cases - multiple aortic arch branch grafting - 27 (34,2%). In the group of the multiple prosthetics of the aortic arch branches in 17 cases (21,5%) the main prosthesis was inserted into the brachiocephalic trunk or right common carotid artery with the side insertion into the left common carotid artery or right subclavian artery, in 10 cases (12,7%) bifurcation prosthesis was performed.

In hospital complications: thrombosis - 3 (3.8%), strokes (right hemisphere) in 3 (3.8%) cases, bleeding for which resternotomy was performed in 4 (5.1%) cases, mediastinitis - 6 (7 .6%), myocardial infarction - 4 (5.1%), deaths in ¬3 (3.8%) cases. Patients with prosthesis thrombosis in the postoperative period were significantly more likely to develop stroke (p=0.003) and mediastinitis (p=0.000).

The survival rate at 5-year follow-up was 92%, 10-year follow-up was 78%, 15-year follow-up was 68%. The long-term patency at 5 years was 95%, at 10 years - 95%, at 15 years – 85%. Stroke freedom at 5 years was 88%, at 10 years - 72%, at 15 years – 60%. There were no statistically significant differences in the influence of the plastic material of the prosthesis (Dacron or PTFE) on the long-term patency. The development of prosthetic thrombosis was accompanied by the occurrence of neurological deficit in only one observation, and at no time did the stroke serve as a cause of death in the remote period.

Conclusion. Prosthetic replacement of the innominate artery has proved to be a safe and reliable technique providing long-term patency and freedom from neurological deficit in the practice of cardiovascular surgery.

INITIAL SINGLE-CENTER EXPERIENCE WITH NEW BIORESTORATIVE, POLYMER-BASED VASCULAR HEMODIALYSIS GRAFT

Giulia Anna Sala, Federico Villa, Matteo Tozzi, Marco Franchin, Maria Cristina Cervarolo
Department of Vascular Surgery, Insubria University, Varese, Italy

Introduction and Objective: The aXess graft (Xeltis, Eindhoven, NL) is a new, biorestorative, polymer-based, electrospun graft used to create vascular access for hemodialysis (HD). Its porous structure allows it to naturally evolve into a living blood vessel when colonized by patient's own tissue. This process is called Endogenous Tissue Restoration, or ETR, and has been widely characterized in pre-clinical models. Additionally, the graft includes a nitinol frame that provides kink resistance and vessel support in this highflow, high-pressure environment. The aXess graft is currently in a first-in-human clinical trial and we aim to present our single-center experience with it.

Methods: So far, we have enrolled 3 patients with end-stage renal disease. All patients have received a lower arm loop configuration, with the exception of one patient who\ had the outflow anastomosis above the elbow. Follow-up visits have been performed according to aXess FIH protocol (NCT04898153).

Results: There were no intra-operative complications during all 3 procedures. Cumulative primary and secondary patency are 100%, with an average follow-up time of 5.8 months. In the patient with the graft crossing the elbow, the extra kink and crush resistance provided by the nitinol frame allowed for a straightforward and tension-free implant. Two of the patients haven't required dialysis yet. The patient who currently requires HD has completed approximately 60 successful HD sessions through the graft. Clinical surveillance demonstrates a palpable thrill across all the graft. Regular doppler ultrasound follow-up hasn't documented any imagiologic complications such as intimal hyperplasia or graft stenosis, and an increase in graft compliance can be observed over time, which can be explained by the ETR process.

Conclusions

The aXess HD graft is a promising device in the vascular access space. Initially implanted as a polymeric graft, aXess has the ability to transform itself into a living

vessel over time, potentially combining the advantages of arteriovenous fistulas and arteriovenous grafts.

FATE OF ILIAC ARTERIES AFTER OPEN REPAIR OF THE INFRARENAL AORTA WITH STRAIGHT TUBE-GRAFTS: A PROPENSITY MATCHED COMPARISON

Santoro A., Kahlberg A., Salvati S., Bugna C., Mascia D., Melissano G., Chiesa R.
"Vita-Salute" University, Scientific Institute H. San Raffaele, Milan, Italy

Introduction and Objectives: This study aims to evaluate the behaviour of iliac arteries (IAs) during follow-up after straight aortic tube-graft replacement of infrarenal abdominal aortic aneurysms (AAA), and to identify potential predictors for iliac aneurysmal evolution needing reintervention.

Methods: Data of patients who underwent AAA open repair with aorto-aortic straight graft reconstruction between January 2012 and December 2019 at a single Institution were retrospectively reviewed. Patients were included in the study if detailed pre-operative CT-scan images were available. Pre, intra and post-operative variables were tested for possible correlation with iliac aneurysmal evolution requiring reintervention during follow-up, using univariate and multivariate models. All screened IAs were divided in 2 groups according to their IAs pre-operative diameter: <18 mm (group A) or ≥18 mm (Group

B). Propensity score matching (PSM) was performed obtaining two homogeneous groups. Covariates included were: age, gender, hypertension, smoking habit, hyperlipidemia, and cardiac disease. Freedom from iliac reintervention was investigated in matched group A and B by Kaplan-Meier analysis.

Results: Two-hundred eighty-nine patients (261 males – 90.3%; age: 72.0 ± 7.8 years) were included in the study, meaning that 578 IAs were analysed. Mean pre-operative diameter of common IA was 14.3 ± 4.3 mm. At a mean follow-up of 48.5 ± 28.1 months, 5 (1.7%) patients underwent an endovascular repair for aneurismal evolution of 6 common iliac arteries (CIAs): 5 aneurysms were treated with iliac-branch stent-grafts, and one with a standard stent-graft and concomitant occlusion of the internal iliac artery. The median time to reintervention was 35.4 (range 32.8 - 50.2) months. In subgroup analysis, 468 IAs (81%) were included in Group A, and 110 (19%) in Group B. Iliac arteries in group B were significantly more tortuous (p<0.001, Pearson correlation: 0.175) and calcified (p=0.025, Pearson correlation: 0.093). After PSM (1:1), 110 IAs per group were identified and tested for iliac related reintervention by using Kaplan-Meier analysis. Freedom from iliac reintervention at 5 years was 100% in Group A and 95,2% in Group B (log-rank test, p=0.043).

Conclusions: Reintervention rate for iliac aneurysmal evolution after open straight tube-graft repair of AAA is generally low at mid-term follow up. Pre-operative iliac diameter ≥ 18 mm is associated with an increased risk of late reintervention. Careful follow-up in these patients should be considered.

OPTIMIZATION OF ENDOVASCULAR TREATMENT OF PATIENTS WITH ACUTE LOWER LIMB ISCHEMIA WITH COVID-19.

Dzhurakulov Sh.R., Shukurov I.Kh.
Pirogov Russian National Research Medical University, Moscow

Introduction: currently, in the context of the new COVID-19 coronavirus infection, endovascular methods are taking an increasing place in the treatment of acute arterial obstruction.

Objective: to analyze the results of catheter thromboaspiration in acute arterial obstruction of the popliteal-ankle segment in patients with COVID-19.

Materials and methods: the results of catheter thromboaspiration performed in 37 patients with acute arterial obstruction of the lower extremities, developed against the background of COVID-19, who were treated at the O.M. Filatov City Clinical Hospital No. 15 in the period from October 2021 to February 2022, were studied. Among the operated patients there were 26 men (70.3%) and 11 (29.7%) women. The average age of the patients was 69.8±6.7 years.

Results: immediate angiographic success of catheter thromboaspiration was achieved in 28 cases (73.6%). Repeated interventions were not required in 13 patients (35.1%). Repeated operations for recurrent thrombosis of the arteries of the lower extremities were performed in 14 patients (37.8%) (in 13 cases for retrombosis of the native artery and in one case due to stent thrombosis). Post-operative extensive hematomas were reported in two patients (5.4%). Amputation of the lower extremities was performed in 6 patients (16.2%). 14 patients (37.8%) had a fatal outcome.

Conclusions: catheter thromboaspiration can be used for acute arterial obstruction of the popliteal-ankle segment in patients with COVID-19.

3Y RESULTS OF ENDOVASCULAR PROCEDURES ON INFRAINGUINAL GLOBAL LIMB ANATOMICAL STAGING SYSTEM (GLASS) GRADE 3-4 PATIENTS IN A SINGLE-CENTER EXPERIENCE

Vacca F, Zacà S, Ramundo RM, Passabì MC, Ringold M, Sodero F, Chiarelli A, Pulli R, Angiletta D
Department of Emergency and Organs Transplantation, "Aldo Moro" University of Bari, School of Medicine, Bari, Italy

Introduction and Objective: The Global Vascular Guidelines aim the decision making in Chronic Limb-Threatening Ischemia (CLTI) by providing a framework for evidence-based revascularization (EBR). The Global Limb Anatomic Staging System (GLASS) estimates the extent and anatomical distribution of the infrainguinal obstructive lesions reflecting the type of surgical revascularization. Aim of the study is to report the long-term outcomes following endovascular procedures on infrainguinal GLASS grade 3-4 in patients deemed unfit for open bypass.

Methods: This is an observational, retrospective, single-center experience of a tertiary referral center. From January 2016 to January 2022, all patients with CLTI affected by infrainguinal disease were identified. Infrainguinal GLASS grade 3 and 4 cases were split in the group A and B with 71 and 80 patients, respectively. A comparison between the two groups was conducted for demographics and operative details. Immediate outcomes were defined by technical and hemodynamic success (ABI improvement). Early outcomes were evaluated at 30 days in terms of mortality, thrombosis, reintervention and amputation (minor and major). Late results were analyzed at 3 years in terms of overall and groups estimations and defined by survival (all-cause mortality), freedom from target lesion revascularization (ff-TLR), freedom from reintervention (ff-R), late lumen loss and freedom from minor or major amputation.

Results: Mean age was 71.2±10.3. No significant differences were observed in terms of Rutherford's clinical stage (p= .332). Groups were homogeneous for baseline characteristics apart from COPD (p= .008) and Diabetes (p= 0.045), represented mainly in the B and the A group, respectively. 128 (84.7%) balloon angioplasty and 23 (15.3%) stent implantation were performed. The groups differ for type of balloon angioplasty (p= .019), in fact B group underwent DEB angioplasty in most cases. Technical success was achieved in 135 (89.4%) cases and hemodynamical success showed an ABI significant improvement (pre-operative vs post-operative, 0.25±0.17 vs 0.63±0.34, p= .001). Early results showed 3 (1.9%) deaths, 9

(5.9%) thromboses, 2 (1.3%) reinterventions, 5 (3.3%) minor and 5 (3.3%) major amputations. Groups did not differ significantly for early results. Mean age of follow up was 26±10 months. Overall survival was 61% and estimations did not differ between the groups (log-rank .184, *p*= .668). Overall ff-TLR was 57.2% with no differences between the groups (log-rank 1.555, *p*= .212). Overall LLL was 70.1% and LLL was observed mainly in the B group, but data did not show significant differences (log-rank 3.456, *p*= .063). Overall ff-R was 53.4% without any differences between the groups (log-rank 1.866, *p*= .195). Overall freedom from amputation was 70.9% for major and 80.5% for minor. Minor amputation affected mainly A group (ff-amputation A vs B, 68.2% vs 90.3%, log-rank 5.156, *p*= .023). No differences were observed for major amputations in the two groups (log-rank 2.470, *p*= .116).

Conclusions: Long-term results of endovascular procedures reflected the new GLOBAL indications for surgery. No differences were found in terms of survival, late lumen loss, freedom from TLR and limb salvage rate, except for the minor amputation; this could be due to the higher prevalence of diabetes in the fem-pop group 3, in patients unfit for open bypass endovascular therapy could be an option with satisfactory results also in FP Grade 4 subjects.

ENDOVASCULAR TREATMENT OF THORACOABDOMINALO ANEURYSM RETROGRADE VS ANTEGRADE CANNULATION FOR BRANCHED ENDOVASCULR AORTIC REPAIR: CASE CONTROL STUDY

E. Visciglia, C. Pallini, M. Bastianon, FR Pisa, S Di Gregorio, G. Spinella, G. Pratesi
Department of Vascular Surgery, Hospital San Martino, Genoa, Italy

Introduction and Objective: An alternative approach to the antegrade branches using TFA compared with conventional UEA was introduced. The aim of our study was to evaluate branch-related outcomes of the TFA retrograde cannulation compared with the TAA anterograde cannulation.

Methods: From January 2015 to October 2022, 95 consecutive patients underwent F-B/EVAR. 32 patients underwent BEVAR for thoracoabdominal aortic aneurysm and 1 for dissection divided into two groups according to the TFA or TAA cannulation approach used. Early end points were technical success, time of intervention, fluoroscopy time, access and systemic complications. Branch instability was evaluated with Kaplan-Meier curves in the follow-up.

Results: The TFA group included 32 patients (median age, 74 years) Technical success was greater in the TFA group (100%) than in the UEA group (79%). The fluoroscopy time (median, 117 minutes; vs 122 minutes) and contrast agent volume were similar in both groups. The radiation exposure (median 448,6 vs 459,28) was lower and the operation time (median, 251 minutes vs 303 minutes) was shorter in the TFA group. Brachial access complications and perioperative strokes/transient ischemic attacks occurred more in the UEA group.

Conclusion: Despite the limitations regarding the study design and limited population, our experience showed that a retrograde approach is safe and effective for branch cannulation during BEVAR by using steerable catheter, in both elective and urgent settings.

ANATOMICAL RECONSTRUCTION OF AORTIC BIFURCATION WITH ENDOLOGIX AFX UNIBODY STENT-GRAFT IN AORTO- ILIAC OBSTRUCTIVE DISEASE

Zacà S, Vacca F, Ringold M, Sodero F, Ramundo RM, Passabì MC, Chiarelli A, Angiletta D.
Department of Emergency and Organs Transplantation, "Aldo Moro" University of Bari School of Medicine, Bari, Italy

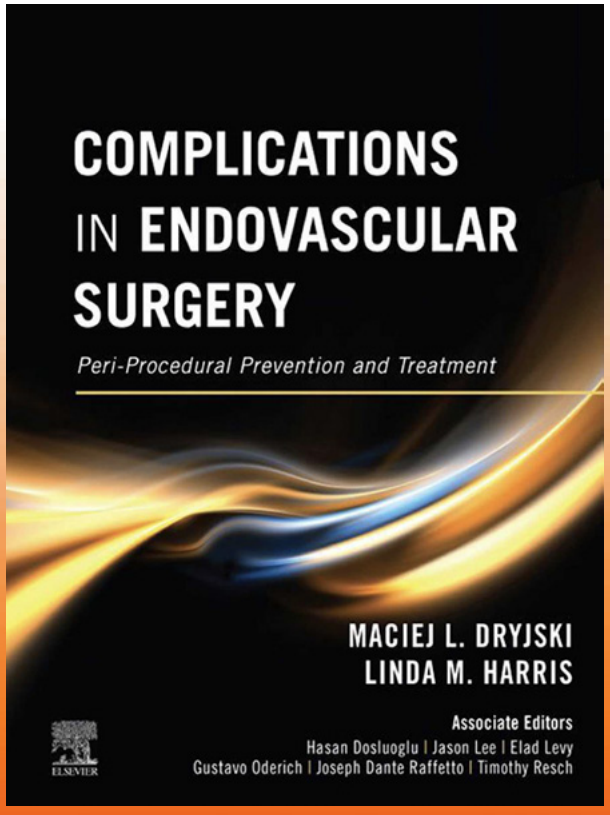
Introduction and Objective: Endologix AFX stent-graft is advocated for the endovascular aneurysm repair (EVAR) in infrarenal abdominal aortic aneurysm. The off-label adoption of the unimodular bifurcated part of the stent-graft (Unibody) may represent a tailored solution for anatomical reconstruction of aortic bifurcation especially in young patients affected by an aorto-iliac obstructive disease. Aim of our study was to evaluate the outcomes of endovascular reconstruction of aortic bifurcation with AFX Unibody in young patients affected by an obstructive arterial disease that involves the infrarenal aorta and the aortic bifurcation.

Methods: A retrospective review was conducted on 275 patients treated for aorto-ilio-femoral disease with endovascular or hybrid procedures from January 2016 to September 2022 at our department. We considered 31 patients (3 females, 9.7%) affected by infrarenal aortic obstructive lesions that underwent endovascular/hybrid (CFA endarterectomy) reconstruction of aortic bifurcation with AFX Unibody stent-graft. Obstructive lesions were classified with TASC II stages and Rutherford's clinical categories identified the degree of peripheral arterial disease. Early results were analyzed in terms of 30-day thrombosis, amputation and death. Follow up results were analyzed by life-table analyses (Kaplan-Meier curves) in terms of 3-year primary and secondary graft patency, freedom from reintervention, amputation free survival and overall survival.

Results: Mean age was of 66.1 ± 8.8 years. Most of the lesions were TASC II D (25/31 – 80.6%) and Rutherford's category 3 was predominant (20/31 – 64.5%). More than two-third of the cases were affected by an obstructive lesion of the aortic bifurcation (24/31 – 77.4%) and in the remaining cases the obstructions involved the infrarenal aorta below the level of renal arteries. Technical success (intention-to-treat analysis) was achieved in all the cases and no open surgical conversions were recorded. Surgical complications rate was 11.1% (3/27 cases) and no post-operative deaths were observed. Ankle-brachial index (ABI) improvement was significant (mean preoperative ABI – postoperative ABI, 0.42 – 0.83, p= .0001). One major amputation and thrombosis (iliac leg acute occlusion) were recorded at 30 days respectively and early survival

rate was 100%. The 90.3% (28/31) of the cases have an active follow-up and its mean age was 18.1 ± 12.9 months (Range 1 – 76 months). Estimated overall 3-year survival (all-cause mortality) was 71.3%. Estimated 3-year primary and secondary graft patency were 79.8% and 83.1% respectively. Estimated 3-year freedom from major amputation and freedom from reintervention were 100% and 96.4% respectively.

Conclusions: The off-labeled adoption of AFX Unibody stent-graft in the anatomical endovascular reconstruction of aortic bifurcation for selected patients offered promising results in terms of effectiveness and safety. The reconstruction of the aortic bifurcation allowed surgeons to easily perform further up-and-over procedures especially in young patients with multilevel obstructive disease. Further studies are warranted to analyze the long-term advantages and the cost-effectiveness of the technique.



Publication Date: 04/2021
PRICE: 190€

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