OFFICIAL LECTURE

ENDOVASCULAR VENOUS PROCEDURES IN THE DEEP VENOUS SYSTEM

ABSTRACT:

Introduction: Nowadays endovascular venous procedures in the deep venous system (DVS) are well known. They are used in both acute and chronic lesions. Their most common use in acute lesions is with filters to prevent pulmonary embolism (PE) and in the deep vein thrombosis (DVT) of the iliofemoral sector to prevent damage caused by the later appearance of the post-thrombotic syndrome (PTS). In the chronic disease, their use seems to be justified in severe cases of chronic venous insufficiency (CVI) and, in recent years, we have seen that the number of procedures has also increased noticeably as their results are very encouraging. Also, thanks to a better understanding and more accurate add-on studies, there is a rise in the treatments of the pelvic congestion syndrome, which, as we know, through the so-called leak points, often manifests itself with varicose veins in the lower limbs, among other symptoms.

Aim: To make a literature review of the different aspects of endovascular procedures in the deep venous system and to add personal experience.

Materials and methods: The following issues were addressed: Vena cava filters / Pharmacomechanical thrombolysis for iliofemoral DVT / Venoplasty of post-thrombotic iliac vein lesions / Venoplasty of NON-thrombotic iliac vein lesions / Endovascular treatment of the pelvic congestion syndrome.

Conclusions: The development of the different endovascular treatments for the venous system has caused changes in all aspects, thus increasing survival and reducing morbidity, which exceeds the limits of conventional surgery.

AUTHORS:

DÁNDOLO, MARCELO ADRIÁN

Presented during the 43th Conference on Angiology and Cardiovascular Surgery Argentine Association of Angiology and Cardiovascular Surgery

Sheraton Hotel,

Buenos Aires, Argentina

November 14-17, 2016

CORRESPONDENCE:
mandandolo@gmail.com

FIRST PART

INTRODUCTION

Nowadays **endovascular venous procedures in the deep venous system** (DVS) are well known. They are used in both acute and chronic lesions. Their most common use in **acute** lesions is with filters to prevent pulmonary embolism (PE) and in the deep vein thrombosis (DVT) of the iliofemoral sector to prevent damage caused by the later appearance of the post-thrombotic syndrome (PTS). These procedures today are supported by an increasing number of users. In the **chronic** disease, their use seems to be justified in severe cases of chronic venous insufficiency (CVI) and, in recent years, we have seen that the number of procedures has also increased noticeably as their results are very encouraging. Also, thanks to a better understanding and more accurate add-on studies, there is a rise in treatments of the pelvic congestion syndrome, which, as we know, through the so-called leak points, often manifests itself with varicose veins in the lower limbs, among other symptoms.

Therefore, in this lecture, we will deal with procedures for acute diseases:

1) Vena cava filters.
2) Pharmacomechanical thrombolysis for iliofemoral DVT

And for the chronic pathology:

1) Venoplasty of post-thrombotic iliac vein lesions
2) Venoplasty of non-thrombotic iliac vein lesions.
3) Endovascular treatment of the pelvic congestion syndrome

VENA CAVA FILTERS:

Brief history of the interruption of the inferior vena cava

In 1784 John Hunter performed the first ligature of the femoral vein in a patient with thrombophlebitis. (1) In 1868 Trousseau suggested the ligation of the inferior vena cava (IVC) as probable treatment for the interruption of the way of production of pulmonary embolism (PE). Bottini is who in 1893 prevented PE with the ligation of the IVC but did not report its success. (1) These techniques have been performed for years: first, the ligation of the bilateral common femoral vein with an unacceptable incidence of PE as well as the sequels of venous stasis in the lower limbs. Then, the ligation of the IVC, frequently performed until the end of the 1960s, seemed to be more successful in controlling PE. (1) However, this technique also delivered unacceptable results in terms of high postoperative mortality rate, recurrent PE and post-thrombotic sequels in the lower limbs.

To mention some statistics which led to the disuse of these procedures, mortality ranged from 19% to 39%, reaching 41% in case of patients with underlying heart diseases (2,3), while 40% of lower limb edema, 20% of varicose veins, 14% of disabling venous claudication and 6% of ulcers were reported. (2) In the light of these data, it was understood that the limitation of the cardiac output after ligating the IVC in patients with heart diseases was what increased the mortality rate (4), which, in addition to the recurrence rate, led to conceive techniques to filter emboli without interrupting it. Thus, IVC sutures were used for more than a decade with plications, foldings with staples and clips externally applied to create limited blood flow, filtering clots in caval circulation. The Adams-DeWeese clip stood out at that time. (5,6) The rapid obstruction of external devices was observed on short-term follow-up, thereby their use declined quickly after the logical advent of intravenous devices. (7)

The first device that gained popularity was the umbrella of Kazi Mobin-Uddin, but the appearance of some problems, such as a high rate of IVC thrombosis (36% to 47%), the formation of thrombosis proximal to the device, 3% recurrent PE and occasionally its migration to the pulmonary artery, were evidenced in the short term. This device was recalled in 1986 due to its high rate of complications with the advent of much more reliable second-generation devices. (8,9,10)

Indications for the placement of vena cava filters (VCFs)

VCF placement indications are divided into absolute and relative. The following table shows the indications accepted in different current consensus statements and papers, and below some highlights will be detailed.

TABLE 1: Indication for the insertion of a VCF (1,11)

Absolute indications	DVT or PE documented in patient with anticoagulation contraindication
	Recurrent PE in patient with (Ineffective anticoagulation)
	Anticoagulation complications forcing interruption
Relative indications	Immediately after a pulmonary embolectomy
	Large floating iliofemoral thrombus demonstrated in a high-risk patient
	Iliofemoral thrombus spreading despite adequate anticoagulation
	Chronic PE in a patient with pulmonary hypertension and pulmonary heart disease
	Patient with DVT and poor cardiopulmonary reserve
	Septic PE
	Patient with high risk of anticoagulation complication (severe ataxia, falls)
	Poor compliance with anticoagulant medication
	Difficulty to establish the therapeutic anticoagulation

Absolute indications are those which today are accepted unequivocally when the named case comes up. Elaborating on the absolute indications referred to in Table 1, the most common anticoagulation contraindications are in patients with recent bleeding episodes such as gastrointestinal bleeding and hemorrhagic stroke, in patients in immediate postoperative period after major surgery, mainly neurological, and finally in patients suffering from blood dyscrasia such as thrombophilia, hemophilia, etc. Meanwhile, inadequate anticoagulation in patients with PE occurs in approximately 18% of cases. These are the patients in whom we must place the VCF, but we must continue with anticoagulation as this therapy showed a lower incidence of IVC occlusion and therefore of post-thrombotic syndrome (PTS). According to different case studies, anticoagulation complications are present in a 10%-18% range, with hemorrhagic stroke, gastrointestinal bleeding, postoperative bleeding, skin rash and heparin-induced thrombocytopenia as the most common ones.

Relative or case-selective indications (1) are those in which we adapt the VCF indication to the pathology of the patient and the moment of his/her illness. Usually discussions arise among the participating doctors as they try to agree on the therapeutics that offers the patient greater guarantees. Those listed in Table 1 are the most frequent and supported ones according to consensus statements. (11) Special mention should be made of septic PE, which for some authors falls within VCF indications (1,11) and for others is a VCF contraindication (12,13). Particles generated in septic processes from infected heart valves, peripheral septic thrombophlebitis and infected venous catheters or other less frequent infectious processes such as chronic mastoiditis, osteitis and oropharyngeal bacterial processes with subsequent thrombophlebitis of internal jugular vein (Lemierre's syndrome) are not potentially infective for inert materials commonly used in the manufacture of filters such as stainless steel or titanium; on the contrary, animal studies showed that thrombi trapped in devices with proper antibiotic treatment were sterilized. (14) A study of 175 patients with sepsis at the moment of VCF placement makes clear that mortality is not related to the placement of the VCF but to the ongoing disease and also that anticoagulation and VCF patients had a low rate of recurrent PE (1.7%) and were better than those with no VCF (15). We believe that acting with certainty based on current evidence on the subject is not possible.

SCIENTIFIC EVIDENCE

It should be stressed that classic indications have hardly changed over the years; however, current indications have little weight in terms of evidence-based medicine and are governed more by the belief of what should be done and what leaves the attending doctor with a clear conscience than by scientific evidence, possibly by the small number of patients. This scientific evidence was taken from the eighth edition of the American College of Chest Physicians guidelines for the treatment of venous thromboembolic disease. (16) The grades of evidence in the indication of VCFs for DVT cases are the following:

- In patients with deep venous thrombosis, the routine use of inferior vena cava filter is not indicated (Grade 1A).
- The use of inferior vena cava filter is indicated in patients with deep venous thrombosis who present contraindication to anticoagulation therapy due to risk of bleeding (Grade 1C).
- Patients with DVT who have received a vena cava filter as an alternative to anticoagulation should receive conventional anticoagulant treatment once the risk of bleeding is resolved (Grade 1C).

And for PE cases, the grades of evidence are the following:

- In patients with pulmonary thromboembolism, the routine use of inferior vena cava filter is not indicated (Grade 1A).
- The use of inferior vena cava filter is indicated in patients with pulmonary thromboembolism who present contraindication to anticoagulation therapy due to risk of bleeding (Grade 1C).
- Patients with pulmonary thromboembolism who have received a vena cava filter as an alternative to anticoagulation should receive conventional anticoagulant treatment once the risk of bleeding is resolved (Grade 1C).

Studies following the publication of these guidelines compare the degree of support to them in relation to results. Thus, recent studies establish the comparison between the clinical characteristics and outcomes of patients who have received a VCF by following the above-mentioned recommendations or not, concluding that data did not support the use of a VCF without following the recommendations of the American College of Chest Physicians guidelines (16, 17) in patients without prior DVT and tolerant to anticoagulation therapy, these having a low risk of developing PE. From what was learnt, we see that knowledge on this subject is dynamic or

there is no definition yet. In the CHEST AT9th guidelines, the conclusion is that permanent VCFs increase the risk of DVT and decrease the risk of PE including fatal PE and have no effect on venous thromboembolic disease (VTD, combination of DVT and PE) or on mortality, based on the PREPIC study. In relation to the update of the CHEST AT9th guidelines (39), and based on the recent publication of the PREPIC 2 trial (40), we find new changes. The PREPIC 2 trial states that VCFs used for 3 months do not reduce the recurrence of PE, including the possibility of fatal PE, in anticoagulated patients with PE, DVT and additional risk factors. As we see, this is opposed to CHEST AT9th. What is affirmed then in the update of CHEST AT9th guidelines is that, for patients with DVT or PE who are treated with anticoagulants, the use of a VCF is not recommended (Grade 1B). (39)

PROPHYLACTIC VCF INDICATIONS

There is a new group of indications promoted since 2005 (18) that gave rise to an increase in the rate of VCF placement in the last years. These indications divide into two groups and are: 1) PE prophylaxis in patients with diagnosed DVT, and 2) true prophylaxis, patients with no DVT or PE (venous thromboembolic disease, VTD) but with high risk. Table 2

TABLE 2. Prophylactic VCF indications (18)

Patients with DVT but no PE (PE prophylaxis)	Patients with reduced lung function who would not tolerate a pulmonary embolism
	Iliofemoral thrombus spreading
	Recent deep venous thrombosis (DVT)
	A history of recent major surgery
	Pregnancy with proximal DVT (depending on the trimester)
	Thrombolysis patients
	After a thrombectomy of iliofemoral thrombosis
Patients with high risk of PE (true prophylaxis)	Patients with single or multiple trauma
	Prolonged immobilization or paralysis
	Patients who underwent major surgery and with anticoagulation contraindication or ineffectiveness
	In cases of gastric surgery for morbid obesity
	Hypercoagulability
	A history of venous thromboembolic disease
	Cases of tumor malignancy, especially in patients undergoing chemotherapy treatments
	After venous reconstructions or endo procedures

These prophylactic indications are based on the use of short-term devices, i.e. temporary or removable VCFs, which we will see below, and are subject to revisions that will arise from future studies.

VCF CONTRAINDICATIONS

Contraindications to the placement of VCFs are few and are summarized in Table 3.

TABLE 3. VCF contraindications. (11)

	There is no venous access available for the implant
	There is no place available for the placement of the VCF

Some authors include a marked decrease in platelets as a contraindication, but it should be noted that this situation may be temporary or correctable; others, as already mentioned, include septic PE.

TYPES OF FILTERS:

VCFs can be classified according to the time they remain in place; thus, those which will never be removed are called permanent. Removable are those which will remain for a limited period corresponding to the time that the anticoagulation contraindication and PE risk last, taking into account that, if this period extends on average for more than three weeks, its removal will be convenient to avoid complications. The last group consists of filters that remain attached to the catheter attached to the patient's skin and are used when there is certainty that the time that it will be needed is extremely short. Table 4 presents this classification and the ones most used in the different types.

Permanent	Greenfield (stainless steel 1988, titanium 1991)
	VenaTech
	Bird's Nest
	Simon Nitinol
Removable	Günther Tulip
	Optease
	Nitinol recovery
	Ella filter
Temporary	Filcard
	Tempofilter

Table 4. Classification of VCFs.

Today it is possible to add to the classification an additional type of VCFs: the **convertible ones**. These devices can pass from "active" to "inactive" mode with a simple percutaneous maneuver, thus turning into a stent. This avoids dangerous maneuvers to remove the filter. Current related studies are still few. (11) The filter is called **Vena Tech Convertible** and is not available in our country for now; we should wait for the results of its use although the conceptual idea of this device is tempting. What is interesting and positive about this

design is the initial report of fewer IVC wall lesions during conversion as compared to the extraction of removable VCFs and that it is possible to be left in "active" mode for a longer time with an average of 121 days. (41)

To choose the appropriate VCF for each case, first we should know the characteristics of the devices most used and available in our country. Thus, we could search for an "ideal" VCF with the following characteristics: Low profile, easy insertion, high biocompatibility, prolonged durability, non-corrosive, non-ferromagnetic, non-thrombogenic, removable or convertible. (12) These characteristics were achieved by most current devices, but there are still a few not achieved to obtain the "ideal" VCF, which are: 100% IVC patency, 0% PE recurrence, 0% migration rate, 0% IVC perforation rate.

The most outstanding features of the devices most commonly used are highlighted below. The first one is the titanium **Greenfield vena cava filter**, which is delivered with a 12-F catheter through a 14-F sheath via the jugular or femoral vein, although, given the large French size (device diameter), the femoral via is preferred if the case allows so. In addition, it has fixation hooks that have reduced the migration rate. (19,20) The VenaTech vena cava filter is a cone-shaped VCF introduced in 1986, which is sealed and made from Phynox. This material has similar properties to those of Elgiloy alloy, a material used in temporary pacemaker guidewires. It has radial teeth for the stabilization of the cone with hooks to reduce the possibility of migration of the device. (1) They are usually delivered via the right jugular vein with a 12-F introducer. This VCF is described for use in large IVC. (21) The VenaTech LP (low profile) vena cava filter with a 6-F introducer has recently been launched; the material used, Phynox, has not changed and its purpose is still the same, i.e. for large IVC, as it reaches an unfolded diameter of 40 mm. However, the FDA so far has approved it for 28-mm IVC. (22)

The **Bird's Nest vena cava filter** is a VCF devised for two basic purposes: the filtration of emboli and large IVC (maximum 40-mm diameter). After undergoing changes to its initial presentation, it has a 12-F introducer formed by V-shaped guidewires connected by an uneven swarm of guidewires. The follow-up of its use showed a 1.3% PE rate, a 4.7% IVC occlusion rate and an 85.3% high rate of asymptomatic IVC penetration. (23)

The **Simon Nitinol vena cava filter** is made from a nickel-titanium alloy; as a characteristic, this material is

flexible when cooled and takes the rigid form previously given at body temperature. (1) The design of this VCF is also particular, with a 28-mm diameter dome of eight handles and the bottom similar to the Greenfield-type VCF with hooks to fix to the IVC. It is an attractive device given its characteristics and acceptable French size, but case studies have not delivered very encouraging results. In a detailed report of 44 implant cases with 6-month follow-up, 4% of recurrent PE, 1% of mortality and 20% of IVC occlusions were observed. (24)

As for removable VCFs, first a brief comment will be made on the **Optease vena cava filter**. It is made from nickel-titanium alloy, its shape consists of two cages facing each other with side hooks, and its delivery system is extremely practical as the VCF is sheathed in a cartridge and can be introduced via femoral or jugular vein. Also, the profile is low: 6 French. On the other hand, it has a hook to be removed with the appropriate maneuver. The removal kit has a higher diameter: 8 F. It is recommended for IVC of less than 30 mm in diameter. Its retrieval is safe if done within 23 days after its implantation. Like the **Trapease vena cava filter** (permanent but of similar shape and features), it is criticized for a high thrombosis rate perhaps due to the inadequate filtration of small clots leading to its occlusion and much contact with the IVC endothelium, which may make its removal difficult. (25)

The **Günther Tulip vena cava filter** has been used in Europe since 1992 and in the United States was approved in 2001. Made from Elgiloy, it has a retrieval hook and fixation hooks. Its use was reported also in the superior vena cava (SVC). The results of studies are somewhat contradictory; however, a study on 75 Günther Tulip VCFs in 49 cases presented the successful removal of the VCF only in 35 cases (81%) because, in the other 14 cases, large thrombi were found trapped. The average implant time was 8.2 days. Moreover, 16% and 22% tilting was observed in the VCFs retrieved and in the VCFs not retrieved, respectively, after 30 months. (26)

The **nitinol recovery vena cava filter** is one of the newest devices approved, has hooks for fixation to the IVC wall, is delivered by a 6-F device and its retrieval device is 10 F. This VCF is recommended for IVC of less than 28 mm in diameter. It is a promising device and its initial results are good. (27)

The **Ella vena cava filter** is another removable device available in our country. It has a 7-F sheath and is easy to unfold. It is recommended for IVC of up to 35 mm in

diameter. However, in our experience, this device migrated to the right ventricle of the patient and we were able to retrieve it endovascularly without consequences 20 days after implantation.

VCF USES IN SPECIAL SITUATIONS

There are a number of situations that have increased the use of VCFs in the last years; some of these were briefly discussed when reference was made to prophylactic indications. Thus, we will refer first to patients with severe polytraumatism. In these patients, the risk of DVT is estimated at 58% and the risk of PE is unknown. Of these, around 14% have anticoagulation contraindication, in which case the placement of VCFs is proposed. It is estimated that those who benefit most would be those with spinal cord lesions. This indication has advantages and disadvantages. Regarding the former, we can say that we obtain effective PE prevention and that the VCF would act as an effective bridge until the moment in which we can anticoagulate the patient. As a disadvantage, a higher incidence of DVT was evidenced in patients with VCFs. (28,29)

Another situation of growing interest is the prevention of PE in bariatric surgery. This surgery is considered of high risk and papers support the use of VCFs with good results. Removable VCFs are always used and this maneuver is performed in the fourth postoperative week. (30)

A challenge for the operator is when the thrombus ascends through the IVC compromising the renal veins; this contingency forces an atypical placement over them. Other situations requiring this high placement are the thromboses of the renal veins, DVT and pregnancy with anticoagulation contraindication, and recurrent embolism in a patient with proper infrarenal VCF placement which forces the placement of a second VCF but this time suprarenal.

As regards pregnancy, the implantation of removable filters in the inferior vena cava is indicated when there is absolute contraindication to anticoagulation, PE despite proper anticoagulation therapy, heparin complications such as thrombocytopenia and DVT or PE close to delivery (from 1 to 2 weeks). As anticoagulation must be suspended before and immediately after delivery to minimize the risk of bleeding, this being the period of extension of thrombosis and PE, protection would be given through the insertion of the removable filter in high-risk patients. The protection provided by inferior vena cava filters to prevent fatal PTE

varies between 98% and 99%. (31) The VCF for a pregnant patient is recommended to be removable and be placed suprarenally via the jugular vein. (32) The abdomen of the mother should be protected and exposure to radiation should be limited. In experienced hands, with minimum exposure time, the chances of fetal consequences are almost nil.

In patients with neoplasia, there is no evidence that they benefit from the use of VCFs. Perhaps we should assess its use in patients with a diagnosis of recent metastasis and a history of PE or episodes of neutropenia with reasonable life expectancy and quality of life. (33)

Finally, in patients whose transfer is contraindicated or represents an unacceptable possibility of complications due to their underlying pathology, implantation assisted only by ultrasound, either transabdominal or intravascular, has been proposed. This type of implants in the intensive care unit at the patient's bedside (bedside placement) has the difficulty of interpreting the anatomy of the IVC without radiological confirmation. (34)

VCF REMOVAL INDICATIONS

Many papers and authors support the need to remove the VCF once the period of PE risk is over. (1,11,35,36,37,38) The reasons provided are simple. On the one hand, in most patients the risk of PE is limited in time as it is linked to a momentary pathology and this is reinforced when the treated patient is a young person with prolonged life expectancy. (1)

The PREPIC study (35) gave great impetus to the removal of VCFs. The study was a randomized clinical trial intended to assess the overall effectiveness of the use of VCFs. During an 8-year follow-up, it effectively evaluated 396 patients who randomly received VCFs or not. VCFs were of four different types and all patients received low-molecular-weight heparin (LMWH) or unfractionated heparin (UFH). V/P grammagraphies were performed at the beginning and clinical evaluations were conducted during follow-up. It was demonstrated that, in the VCF group, the incidence of PE at the beginning (short term) was lower (1.1% vs 4.8%) but two years later it reached the same level without differences. As for DVT, the recurrence rate was 20.8% in the VCF group vs. 11.6% in the group without VCFs. This led to consider the VCF as a strong risk factor for recurrent DVT and prompted the use of removable VCFs.

In 2015, the results of the PREPIC 2 study were published. The study sought to identify a subgroup of patients with

acute venous thromboembolic disease (VTD) in which the risk of early recurrence was so high that perhaps the placement of a temporary VCF could improve clinical outcomes as opposed to standard anticoagulation only. The sample consisted of 399 patients with PE associated with VTD (DVT or superficial thrombosis) who had ≥1 additional recurrence risk factor (age > 75 years old, active Ca, RV dysfunction, etc.). Patients were assigned randomly to the placement or non-placement of a removable VCF with 3-month recovery; all patients received anticoagulation for ≥ 6 months. There was no differences in the primary result of recurrent symptomatic PE in 3 months (3% vs.1.5%; P = 0.50); neither were significant differences after 6 months. The authors concluded that, in patients with high PE recurrence risk, the temporary placement of a removable VCF should not be performed routinely.

VCFs generally should be reserved for patients with anticoagulation contraindications. The authors acknowledge that the applicability of these results to certain subgroups of patients (including those with massive PE) is uncertain. (40)

Thus, we could consider the removal of VCFs according to the recommendation presented in Table 5. (37)

Table 5. When to consider the removal of the VCF.

Patient with low PE risk (clinically significant
a. Patient with venous thromboembolic disease (VTD) Anticoagulant therapy for at least two or three weeks
No clinical evidence of progressive or recurrent VTD
b. Patient without VTD (VCF used prophylactically) Prophylactic anticoagulation therapy or VTD risk factors solved
By normal duplex scan of lower limbs without evidence of DVT
Patient compliant with the use of medication and follow-up
Life expectancy of more than 6 months
Unlikelihood of returning to a VTD state
The patient wants the removal of the VCF

Of course in addition to following these recommendations to indicate the removal of the VCF, we should take certain precautions such as having the appropriate material, being within the removal period suggested by the manufacturer of each type of VCF and performing at the beginning of the removal a venacavogram in which we make sure that there

are no large thrombi trapped in the VCF. As regards the exact moment of removal, on average we should not exceed three weeks after implantation since it was observed that after this period IVC lesions increase when the device is removed. If we want to remove the VCF and we need to exceed three weeks, the suggested alternative is to reposition the VCF above or below the primary placement site so as to have three more weeks and avoid the firm adhesion of the device to the vein wall.

However, the VCF removal rate is low. In 80% of cases, VCFs are not removed (38) and, while in our country there are no related statistics available, the non-removal rate is supposed to be even higher. This is due to the lack of patient follow-up by the operator after solving the emergency and, in our country, the economic difficulty derived from the cost of removing materials is important. Regarding follow-up, in some countries records of operators are kept for the operators themselves to be responsible for the removal when it is indicated.

We believe that the prophylactic indication of filters in certain patients should be a priority over the later discussion on their maintenance or removal. The incidence of long-term complications in patients with removed VCFs and in patients with unremoved VCFs should be a reason for prospective studies.

COMPLICATIONS OF VCFs

VCF complications can be divided into three groups: 1) complications related to the VCF placement technique, tilting frequently; 2) complications related to failures in PE prevention due to the small size of thrombi but generally causing non-fatal PE; or 3) long-term complications related to the VCF itself. The latter are very common and include: VCF migration or fracture, VCF thrombosis, erosion of a strut on the IVC wall with penetration into neighboring structures. Penetration into the IVC wall is a very frequent situation, presented by about 25% of VCFs placed. However, in general it is asymptomatic and only a few cases of symptomatic patients with penetration into neighboring structures such as aorta, pancreas, duodenum, right ureter or column are reported. Penetration is due to different causes including respiratory movements, aortic pulsatility and spinal misalignment, etc. (42)

OUR EXPERIENCE

Between 2004 and 2015, we placed 56 VCFs in a 120-bed hospital: 22 in men (40%) and 34 in women (60%). The

average age of patients was 53 years old (24 - 96 years old). The access way was the internal jugular vein in 31 cases (55%) and the femoral vein in 25 cases (45%). As for the placement indications of the sample, 42 cases corresponded to anticoagulation contraindications in patients with DVT, 6 cases were due to inefficient anticoagulation, 3 cases related to anticoagulation complications, and finally 3 cases were grouped as "others" since they do not correspond to absolute VCF placement indications. VCF placement indications in the latter were 2 cases of right kidney cancer with invasion of the IVC and 1 case of femoral DVT of right lower limb with term pregnancy and proven recent PE. Labor was started, the VCF was placed and subsequently a c-section was performed.

The FVC types used were permanent in 19 cases and removable in 37. The highest percentage was the Ella filter model (21), followed by Greenfield (16), Optease (8), Günther (8), Simon Nitinol (2) and VenaTech (1). It should be made clear at this point that in most cases we did not choose the type of VCF to be used, we just decided if they were permanent or removable. In the second half of the sample, we preferred to ask routinely for removable and low-profile VCFs and then to determine whether they would be removed or not. From the sample of 37 removable VCFs, we only retrieved 6 (16.2%). The low extraction rate was due to difficulties in the follow-up of these patients as they are patients with an interdisciplinary treatment and most cases are not led by the vascular surgeon. Follow-up was possible in 39 cases for 5 days to 64 months. As for complications, we had VCF migration to the right ventricle with asymptomatic patient in 1 case, with successful endovascular extraction of the VCF. There were no complications in the extraction of VCFs. Three patients died during follow-up of causes unrelated to the VCF: one 96-year-old patient in the immediate postoperative period after a hip surgery and two patients with neoplasia. ■

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