Benefit vs. Risk of a Permanent Inferior Vena Cava Filter in Pulmonary Embolism with Anticoagulation Contraindication

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**Abstract**
Cases of pulmonary embolism (PE) with contraindication of anticoagulation have low incidence. Under these circumstances the placement of an inferior vena cava (IVC) filter may be life-saving. Paradoxically, the presence of the filter imposes anticoagulation itself, due to the risk of filter thrombosis, promoting stasis and increasing the risk of filter related deep venous thrombosis (DVT) and PE recurrence by means of a substantial collateral venous return that bypasses the IVC filter (1,2). We present the case of a woman with DVT, complicated with high risk PE. After thrombolysis with alteplase the patient develops retroperitoneal hematoma originating from undiagnosed renal angiomyolipoma. Therefore long term anticoagulation is considered contraindicated and an IVC filter is installed. Shortly after hospital release the patient presents occlusion of the IVC filter with DVT recurrence. The initiation of low molecular weight heparin and afterwards of acenocumarol has a favorable outcome, and after six months of follow up the patient is completely recovered.

**Keywords:** pulmonary embolism, deep venous thrombosis, inferior vena cava filter, retroperitoneal hematoma

**Introduction**

Pulmonary embolism is a major cause of morbidity and mortality and in most cases is a consequence of a DVT. The incidence of venous thromboembolism (VTE) increases exponentially with age, about 65% of patients being over 60 years (1). According to a recent survey performed in 358 hospitals across 32 countries, only 58.5% and respectively 39.5% of patients at risk of VTE due to medical or surgical causes, receive adequate prophylaxis (3). The standard treatment for VTE is anticoagulation, with the alternative of implantation of IVC filters when anticoagulation is contraindicated (1). There are no randomized studies to prove the benefit of IVC filters in acute PE, with contraindication of anticoagulation. Our case report emphasizes the challenges of the implantation of an IVC filter.

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CASE PRESENTATION

We present the case of a 68 years old female, hypertensive, dyslipidemic and diabetic, admitted to our clinic for dyspnea at rest since one week, sudden onset of intense chest pain, since one hour, and right leg pain and swelling. Two months previously she underwent surgery for a right tibial plateau fracture, resolved by fixation with plate and screws. After surgery the patient received, according to the recommendations of the current ESC Guidelines, antithrombotic prophylaxis with enoxaparin for one month (0.6 ml sc/24 hours for a overweight patient of 80 kg) (4). She also receives treatment for hypertension, dyslipidemia and diabetes with: Candesartan 8 mg/day, Indapamid 1.5 mg/day, Fenofibrat 145 mg/day, Gliquidon 30 mg/day.

The clinical exam on admission revealed: perioral cyanosis, severe dyspnea at rest, hypotension (90/70 mmHg), regular tachycardia (106/min), tricuspid systolic murmur, grade III/VI, with no signs of pulmonary or systemic stasis, oxygen saturation of 88% in atmospheric air, right leg edema, positive Homans sign.

The ECG on admission showed sinus tachycardia, right bundle branch block (RBBB) and S1Q3T3 pattern (Figure 1).

The biological findings were: positive troponin (3 high- 0.225 ng/ml), positive D-Dimer test (5 mcg/ml), respiratory alkalosis. In addition, the patient had leukocytosis (13000/μl) with neutrophilia (76.2%), without anemia (Hb-13.5 g/dl), hyperglycemia (188 mg/dl) and mixed dyslipidemia (high triglycerides- 279 mg/dl and hypercholesterolemia-230 mg/dl).

Cardiac ultrasound at admission revealed dilated right cavities (RV- 42 mm, RA-49 mm), incomplete closure of the tricuspid valve, with severe tricuspid regurgitation, a RV-RA gradient of 24 mmHg and an IVC without inspiratory collapse (indirect signs of pulmonary hypertension), with a preserved LV systolic function (EF>50%). The ultrasonographic examination of the lower limb veins showed right popliteal DVT (9 mm thrombus, fresh looking, with embolic risk).

Based on the clinical and laboratory data presented above the patient was diagnosed with: high risk PE, high DVT of the right leg, right tibial plateau fracture recently operated, arterial hypertension therapeutically controlled, treated type 2 diabetes, mixed dyslipidemia.

According to the current ESC Guidelines on PE (1), in an unstable patient, with high risk PE (hypotension, RV overload signs in ECG and echocardiography and a positive troponin), in the absence of contraindications, thrombolysis is recommended. We performed fibrinolysis with alteplase, 100 mg in 2 hours. After thrombolysis the cyanosis and dyspnea at rest disappeared, blood pressure (BP) increased at 125/75 mmHg and the oxygen saturation increased at 100% (in the atmospheric air), without signs of external bleeding. The ECG showed remission of tachycardia and of the RBBB, with occurrence of negative T waves in V1-V2 (Figure 2). At cardiac ultrasound we noticed the persistence of the dilation of the right heart, but with significant reduction of the tricuspid regurgitation and an inspiratory collapse of the IVC. Anticoagulant treatment with unfractioned heparin was started.

17 hours after thrombolysis the patient described spontaneous pain in the left flank, worsened on palpation, unresponsive to analgesics, associated to a hemoglobin decrease from 13.5 to 7.3 g/dl. For the correction of anemia she received 2 units of RBC. The anticoagulant treatment was stopped and an emergency abdominal CT with contrast was performed, revealing a hematic collection of 3.5 cm thickness, posterior of the left kidney lodge, in intimate contact with a lobular formation in the lower pole of the left kidney, of 9/7.2/6.2 cm, with mixed tissue density (fat, limestone, hematic) – probably angiomyolipoma (similar formations in both kidneys) (Figure 3).

The hemoglobin value was monitored, but, although anticoagulant treatment was stopped and RBC transfusion was administered, hemo-
globin didn’t increase more than 9 g/dl, suggesting a still active bleeding. The platelet count value was normal and the value of the ESR was 55 mm/h. 11 days after thrombolysis, the abdominal CT showed an increase in the dimension of the hematic collection in the inferior pole of the left kidney from 9/7.2/6.2 cm to 18/7.5/5.7 cm and an increase of the retroperitoneal collection from 3.5 to 4 cm thickness, pushing anteriorly the left kidney.

Our case is one of PE secondary to a transient risk factor (leg fracture), with an indication of 3 months anticoagulation (according to the guidelines), but with high hemorrhagic risk and, at the same time, high residual thromboembolic risk (persistent free-floating thrombus in the right popliteal vein). As single alternative to the anticoagulant treatment, the implantation of an IVC filter should be considered. Therefore in our patient, anticoagulation was postponed and an IVC filter was implanted (due to availability reasons, the implanted filter was a permanent one). CT monitoring of the retroperitoneal hematoma at one month was decided and the patient was discharged improved, after 18 days of follow up.

Four days after discharge the patient was readmitted for worsening of the right leg edema, with onset of signs of deep vein thrombosis on the contralateral lower limb. A chest, abdomen and pelvis CT with contrast was repeated, which showed persistent thrombus in the right main pulmonary artery, thrombosis of the IVC filter and of the inferior vena cava distal from the filter, with extension into the left common iliac vein (LCIV) and left external iliac vein (LEIV) (Figures 4 and 5) and stationary aspect of the retroperitoneal collection (10/6/4 cm), which seemed to communicate with the left renal lower angiomyolipoma. Renal angiography was performed, in order to discover potential sources of bleeding. No communication between the renal angiomyolipomatous masses and the retroperitoneal collection was detected, therefore anticoagulation with LMWH was initiated (enoxaparin 0.1 ml/10 kg corporeal weight bid). The treatment with LMWH was maintained for 30 days.

The clinical evolution was favorable, with significant remission of the lower limb edema. Abdominal CT scan was repeated after 30 days and showed remission of the IVC dilatation, persistent thrombosis of the IVC below the filter and the regression of the retroperitoneal

hematic collection (from 10/6/4 cm to 5/2.6/1.3 cm) (Figure 6). Oral anticoagulation was started in this context, with reassessment at 3 months. The abdominal and pelvic CT after 3 months showed almost complete remission of the retroperitoneal hematoma, partial thrombosis of IVC filter in the lower side, partial thrombosis of IVC and left external iliac vein (Figure 7).
We believe that the gradual downsizing of the retroperitoneal collections and the reduction of the thrombus in the veins below the filter, while the patient continues oral anticoagulation withacenocoumarol, indicate a favorable prognostic, at least on medium term. The patient requires further recovery procedures after the fracture and adequate control of blood pressure, blood glucose and lipid profile.

DISCUSSIONS

The presented case is illustrative for the pathophysiological evolution of the venous thromboembolic disease (5-7) (fracture with secondary immobilization → venous stasis and endothelial injury → high DVT → high risk PE) and the importance of an effective prophylaxis after orthopedic surgery (probably in our overweight patient the prophylactic antithrombotic therapy with enoxaparin was under dosed). Also, the findings in our case underline the significance of a proper assessment of the bleeding risk prior to thrombolysis (in our patient, the source of bleeding remains uncertain, most probably being related to the presence of the renal angiomiolypomas).

The implantation of an IVC filter in our patient, according to recommendations of the ESC Guidelines, had an indication class IIb level of evidence B (2). The concept of interruption of the IVC for the prevention of PE was first introduced by Trousseau in 1868, by ligation of IVC (1,8). Later, IVC filters were implanted, first transvenous by venotomy - Mobin Udden umbrella filter in 1967, and then percutaneous - Greenfield filter in 1984 (9-10). Contemporary, there are two types of IVC filters, permanent and optional (retrievable or convertible) (1,11-12). Due to a higher rate of complications in permanent IVC filters, such as recurrent DVT in approximately 20% cases, post-thrombotic syndrome in 40% of cases, occlusion of the vena cava at 5 years in 22% of patients, optional IVC filters are preferable (1,11-14). Optional IVC filters can be removed soon, optimal within 2 weeks of implantation. Disadvantages include filter migration, embolization, IVC perforation with retroperitoneal bleeding, and filter fracture, and are proportional to the period that they are left in place (1,11-12,15-17).

In our patient, for reasons of availability, a permanent filter was implanted, having the disadvantage of life-long anticoagulation. Our case underlines once more the fact that the indication for an IVC filter implantation is a very...
sensitive one: although necessary in patients with anticoagulation issues and high thromboembolic risk, they require anticoagulation per se.

There are no randomized studies to demonstrate the benefit of IVC filters in acute PE with contraindication of anticoagulation. A randomized trial performed 1998 on 400 patients with DVT, with and without PE, with a 8 year follow up, compared the efficacy of isolated anticoagulant treatment to that of anticoagulant treatment combined with the insertion of a vena cava filter. The results of the trial showed that vena cava filters may reduce the risk of recurrent PE but at the same time they increase the risk of DVT and have no effect on survival (14).

CONCLUSIONS

IVC filter can be lifesaving in high risk PE with contraindication of anticoagulation. Nonpermanent filters should be used in VTE related to a transient risk factor. Further randomized studies are needed to define the risk-benefit ratio of IVC filters in acute high risk PE with contraindication of anticoagulation. Also, anticoagulation strategies for IVC filters and indications for permanent and nonpermanent IVC filters should be further assessed.

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