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Review Article

Venacaval filter in venous thromboembolic disease

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Abstract. Venous thromboembolic disease includes lower limb deep vein thrombosis and pulmonary embolism which are dreaded sequelae of certain medical and surgical conditions. This article reviews the use of Inferior venacava filter to prevent pulmonary thromboembolism in patients with deep venous thrombosis.

Key words: Thromboemboli, filter

1. Introduction

Venous thromboembolic disease (VTE) includes lower limb deep vein thrombosis (DVT) and pulmonary embolism (PE) which are dreaded sequelae of certain medical and surgical conditions. In general population the yearly incidence of VTE is approximately 1 per 1000 persons (1). In hospitalized patients it is approximately hundred times more common than in the general population (2). However, this varies with the medical or surgical history of the patient. In medical patients, VTE may be seen in 10-20% of patients vis-à-vis upto 80% in high-risk surgical and critical care patients (1). Fatal pulmonary thromboembolism has reported to be from 0.01%-5% of care depending on the underlying risk factors (3).

Through the years, many tests have developed to diagnose VTE. D-Dimer test is sensitive but not very specific for VTE. A negative D-Dimer result (D dimer <500 ng/ml) can help exclude diagnosis in patients with lower probability of having VTE(4). ELISA tests give highest sensitivity of approximately 95%. D-dimer may also be raised in patients who have had a recent trauma or bleeding, or in those with malignancy. DVT should be investigated for when there is lower extremity swelling, tenderness or pain in limb or increased warmth or erythema. Duplex ultrasound is the initial screening test and has reasonably good sensitivity & specificity (5). However, the study is limited for evaluation of iliac veins especially in obese patients. CT angiography done for the diagnosis of pulmonary thromboembolism may include delayed lower limb scans (Fig.1) for evaluation of DVT. CT angiography has high sensitivity (upto 90%) and specificity (upto 95%) for detecting PE. Although MRI can help detect PE, there is a limitation to its use because of reduced availability and higher cost as compared to CT.

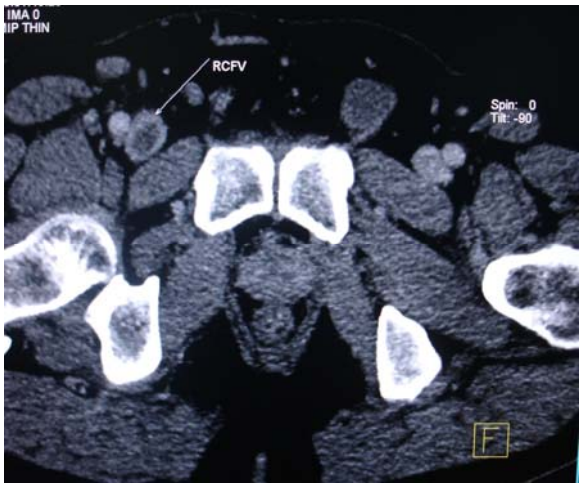

Fig. 1. CT angiogram- Axial image showing central non-enhancing thrombus (arrow) in right common femoral vein. Left sided vein is thrombus free.

Anticoagulants are the mainstay of the treatment for VTE. It is important to have baseline laboratory studies before starting the patient on anticoagulants. Parenteral agents include weight based unfractionated heparin (I/V or S/c), low molecular weight heparin (LMWH) and the synthetic anti-Xa agent Fondaparinux (6).

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However, because of its ease of dosing, lesser need for repeated lab monitoring and lower bleeding rates, LMWH is the recommended agent.

Warfarin is usually started alongwith a parenteral anticoagulant for acute treatment, and is usually started with a dose of 5 mg. The dose is then titrated based on the INR test values till a therapeutic INR is achieved.

Thrombolysis has been recommended in cases of massive PE though the reports are rather controversial for its use. A large single randomized controlled trial of systemic thrombolysis for submassive PE favoured thrombolysis over usual anticoagulants alone with significant difference in the primary outcome(7). Another study compared catheter directed thrombolysis with conventional anticoagulation for acute proximal DVT and showed 6 month patency rate of 72% in former vis-à-vis 12% in patients with anticoagulants alone (8).

Ideally, thrombolysis should be done in patients with significant proximal thrombus load but in an experienced centre.

So essentially systemic anticoagulation with I/V heparin followed by oral Warfarin remains the mainstay of treatment for DVT and for prevention of PE. However, as many as one third of patients develop second PE while on adequate anticoagulant therapy. Also it is associated with hemorrhage in certain patients while in others, anticoagulation may be contraindicated. These include patients with haemorrhagic stroke, bleeding diathesis and CNS metastasis.

The concept of mechanical obstruction of vena cava for treatment of VTE is 140 years old and was first thought of by Trousseau in 1868 (9). It was first introduced surgically for humans in late 1920's (10). High surgical morbidity and complications, however, prompted the advent of IVC interruption using endovascular technique. But these too were involved with problems of limb oedema and phlebitis. Following this, the need for a device acting as IVC filter was felt. And in 1974, the Kimray-Greenfield filter was developed, to be placed percutaneously. Over the subsequent decades, filter design, size and insertion techniques have evolved so much that the complication rates are decreased and the filter use has increased.

2. Vena cava filters

These could be either permanent or temporary retrievable filters. The first over the wire stainless steel Greenfield filter was introduced in 1973. Initially, it was placed via a surgical cutdown in internal jugular vein. But, it was in 1984 that it was first placed via the currently preferred percutaneous route.

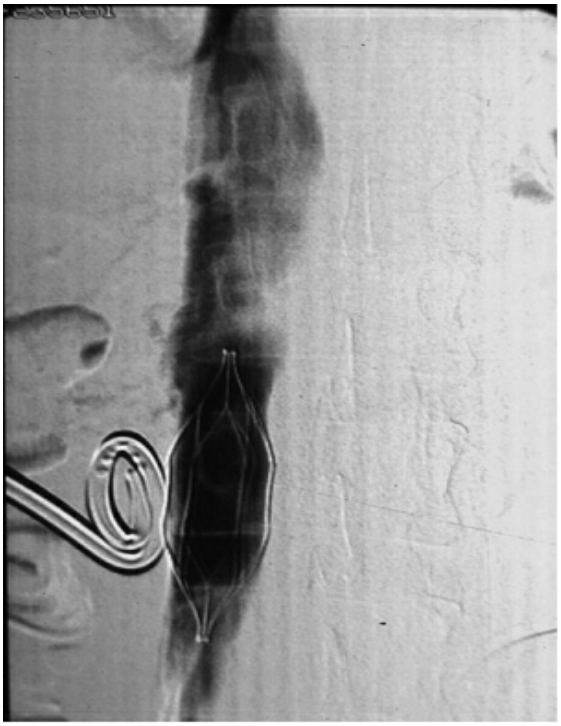

Fig. 2. AP projection of IVC catheter venogram showing a Trapease filter in- situ.

Today, Greenfield filters are much improved with lesser migration rate. The other commonly available filters include- Titanium Greenfield filter (Boston Scientific), Bird's nest filter (Cook, Inc) Simon Nitinol filter (Bard Tech.), Venatech filter (Braun Med.) and the Trapease filter (Cordis Corp.) (Fig. 2). All these filters can be placed percutaneously but differ in their size, shape and in their compositions and delivery system sizes. All filters (except Trapease which was not available at time of the study) were reviewed by Streiff, and all of them were found to have almost equal efficacy in prevention of PE (2.8-3.8%) (11). However, it were the rates of DVT and IVC thrombosis which were different with varying types of filter. Overall, major complication rate of 0.3% was found by Athansoulis et al after a study of 1765 filters of 7 different types (12). Stent migration occurred in 0.1%, filter fracture in 0.2%, caval wall perforation in 0.1% and post filter caval thrombosis in 3.2% of cases.

A study by Decousus et al (13) is the only randomized trial which evaluated permanent vena caval filters. The study reiterated the fact that with use of filters, there are fewer PE's at the expense of more DVTs. Also, the fact that long

term morbidity and mortality are not different from non filter group. It concludes from the study that the systematic use of permanent vena caval filters in general population with VTE is not recommended. This study, however, had its limitations in patient selection and also in the use of anticoagulants.

In general, venacaval filters are indicated in patient in which anticoagulants cannot be used and in whom they have proved to be ineffective in preventing recurrent VTE.

Removeable filters can be removed when the transient risk of PE, for which they were placed, is over. This leads to lesser long term thrombotic complications which are seen with permanent filters. These filters are designed to act as permanent filters if left in situ. The commonly used retrievable filter are –Bard recovery filter (Bard peripheral vascular, Ariz), Gunther tulip (Cook Inc.) (Fig. 3) and Optease (Cordis, NJ).

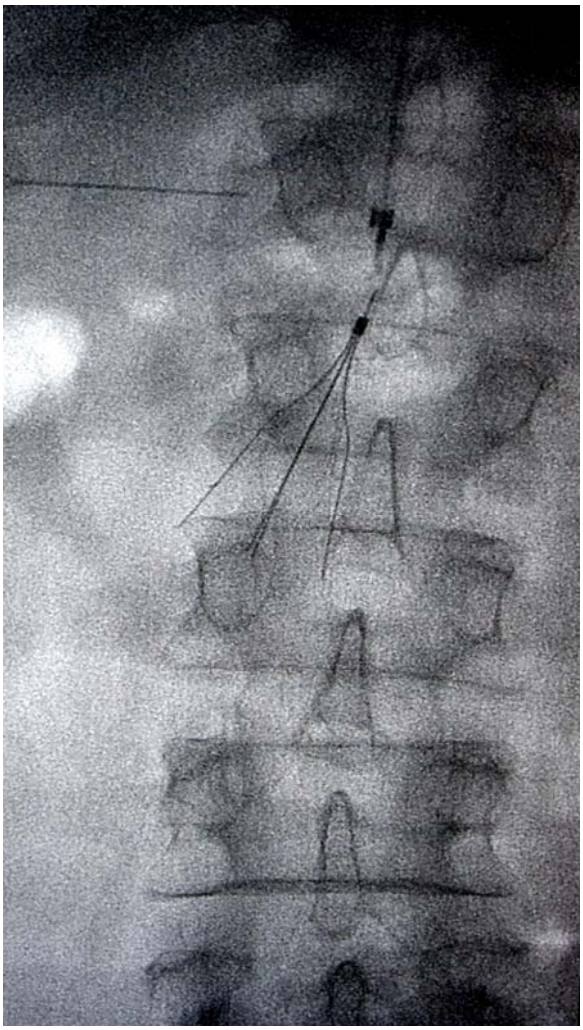

Fig. 3. Fluoroscopic image showing Gunther Tulip filter after it's placement in IVC.

3. Indications for IVC placement

Absolute:

1. In patients with DVT /PE with contraindication or any complication of systemic anticoagulation
2. Recurrent PE despite adequate systemic anticoagulation

Relative Indications:

1. Chronic and recurrent PE in patients with pulmonary HT
2. Poor Cardiopulmonary reserve
3. Free floating large load of iliofemoral thrombus
4. Thrombectomy, embolectomy or thrombolysis of DVT
5. Trauma or high risk surgery
6. Patients with cancer or pregnancy or extensive burns.

With advent of better devices with smaller profile, the technical difficulty in placing these devices is much reduced, with an increasing trend of use in more patients with just relative indications.

There are few relative contraindications to placement of caval filters. These include patients on therapeutic anticoagulants, those with thrombus between proposed access site and the deployment site. The latter has been addressed by the use of alternative jugular approach that is now possible with smaller profile delivery systems.

Fig. 4. CT angiogram- Coronal image showing normal caliber of IVC with no evidence of any thrombus.

Fig. 5. AP projection of venogram done via catheter placed in IVC shows normal caliber of IVC with no filling defects.

4. Techniques of filter placement

Preprocedural assessment of patient is done for presence of DVT and /or PE. Ultrasound and/or CT are done for the same.

If patient is on anticoagulants, then they are discontinued and patient is put on heparin. Heparin should also be discontinued 2-4 hours before the procedure. Ultrasound and /or CT angiography are done for evaluation of IVC patency and caliber (Fig. 4). The mean diameter of IVC is 19-20 mm. Most IVC filters are placed in infrarenal IVC after performing the venogram (Fig. 5). The placement is done via transfemoral or transjugular route in such a way that the apex of the infrarenal filter is across inflow from lowest renal vein so as to minimize dead space between filter and renal veins. However in following conditions, suprarenal filter can be placed-

1. If thrombus is extending in IVC above level of renal veins.
2. If there is inadequate space in infrarenal IVC due to presence of thrombus .
3. PE after ovarian vein thrombosis and in pregnancy.

To summarise, venacava filter placement is a safe and effective means of preventing pulmonary thromboembolism in patients who are at high risk. It is very important to select the patient judiciously, based on the criteria above. However it is not recommended as a prophylactic measure in all the patients with venous thromboembolism.

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