

## Experience with the use of IVC Filters for Prevention of Peri-Operative Pulmonary Venous Thrombo-Embolism in Cancer Patients

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### ABSTRACT

**Background:** Prevention of Venous thromboembolism by use of Inferior Vena Caval (IVC) Filter implantation is increasingly being adopted in cancer patients where the incidence of embolism is high.

**Patients & Methods:** A retrospective analysis of 10 patients in whom the filters were placed prior to surgery for prevention of embolism has been done.

**Result:** All the cases underwent a successful implantation with an uneventful post operative course.

**Conclusions:** Considering the high incidence of thromboembolism in cancer patients and that patients with Deep Vein Thrombosis (DVT) are at very high risk for fatal pulmonary embolism in the perioperative period; this therapy is advisable prior to performance of surgery despite the necessity of continued anticoagulation therapy.

**KEY WORDS:** Cancer Surgery, Deep Vein Thrombosis, Pulmonary Embolism, IVC filters

The magnitude of risk among cancer patients for developing DVT is seven times that of the general population and pulmonary embolism (PE) frequently goes unrecognized, leading to a 15% to 20% mortality rate if not diagnosed and treated properly.<sup>1,2</sup> Incidence of venous thrombo-embolism (VTE) in cancer patients has been reported to be highest when the diagnosis of malignancy is recent. Prevention of VTE by use of IVC filters is increasingly being adopted with the changing design and utility of these filters.<sup>3,4</sup> During the last 4 years, IVC filters are being placed routinely as a preoperative precaution in this centre in patients with recent onset DVT and planned for major extensive surgery.

### PATIENTS AND METHODS

12 cases with DVT with IVC filters were analyzed in this study. Out of these 2 patients underwent an operation twice. Demographic data is compiled in Table-1. Details of diagnosis, surgery done, co-morbid conditions and ASA status are given in Table-2.

### OBSERVATIONS

All cases were adults (35 to 68 yrs), M/F ratio 60:40. All the cases had genitourinary or pelvic malignancy. 7 cases had thrombosis in the Left iliofemoral vessels, two cases in Right group and in 1 case both groups of vessels. 9 cases had the Greenfield filter (Fig-1) inserted and one had a Simon Nitinol filter (Fig-2) placed in IVC. The latter filter had been placed in Sr no. 5 in whom there was DVT in both lower limbs.

**Table 1**  
Demographic Data

Sr No.	Age (yrs)	Sex	Weight (Kg)
1	75	M	55
2*	62	M	50
3	46	F	35
4	66	M	55
5	59	M	68
6	63	F	51
7	59	M	60
8	63	F	60
9*	59	M	60
10	45	F	52

\*Underwent two different surgical procedures after IVC filter implantation

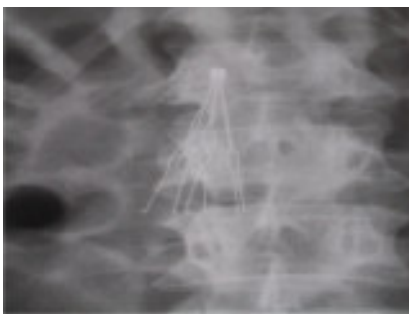
Two cases underwent repeat surgery and in both cases second surgery was for intestinal obstruction. Six cases came for operation within three months of diagnosis and four cases came with advanced disease. Duration of DVT ranged from three months to one year prior to placement of filter. All patients were on Heparin/Low dose unfractionated heparin (LDUH) / Low-molecular-weight-heparin (LMWH) therapy for DVT prior to surgery. No patients had features of pulmonary embolism in the intra or post operative period. However, two patients died, one due to sepsis and one due to renal failure within a month of their surgery. No case had any immediate complication attributed to filter placement.

Long term follow up of these cases have not been fully evaluated largely because the cancer patients were not in hospital for their terminal care. Neither was there any case in which there was evidence of thrombus retained in the

**Table-2**  
*Patient Details*

Sr No.	Type of Malignancy	DVT (Right / Left/ Both) lower limbs	Surgery performed	Comorbid conditions	ASA status
1	Carcinoma Prostate	Left	Loop colostomy	DM, HT, post Radiotherapy, Deranged kidney function.	III
2	Carcinoma sigmoid colon	Left	Hartmann's procedure, colostomy	Pleural effusion, increased liver enzymes	IV
3	Adenexal Mass with intestinal obstruction	Right	Exp laparotomy, colostomy	Ascites, Azotaemia.	IV
4	Carcinoma bladder	Right	1. TURBT 2. Exp laparotomy	Post CABG, Azotaemia.	IV
5	Carcinoma bladder	Both	1. Excision bladder mass and stenting 2. Radical cystectomy with ileal conduit.	Ascites, icterus, Bilateral hydronephrosis in renal failure	IV
6	Carcinoma bladder	Left	Anterior exentration	Anaemia, Deranged Kidney function	IV
7	Carcinoma prostate	Left	Channel TURP	Unstable angina, DM, Renal failure	IV
8	Carcinoma Prostate with obstructive uropathy	Left	Clot evacuation, bilateral nephrostomy	CAD, paraplegia, on renal dialysis	VE
9	Carcinoma Endometrium	Left	Wertheims	DM	III
10	Carcinoma Testis	Left	Orchidectomy with Retroperitoneal lymph node dissection	HT with Bronchial Asthma	III

DM- Diabetes Mellitus, CAD-Coronary artery disease, HT-Hypertension



**Figure 1**  
*Greenfield filter*



**Figure 2**  
*Simon Nitinol Filter*

filter to prove the efficacy of the filters. The fact that none of the filter implanted cases had any complications during the peri operative period and no record of their subsequent hospitalization due to pulmonary embolism indicates that the procedure was useful.

## DISCUSSION

Cancer and its treatments are well recognized risk factors for venous thromboembolism (VTE). Evidence suggests that the absolute risk depends upon the tumour type, stage or extent of cancer, and treatment with antineoplastic agents. Incidence of VTE in cancer patients has been reported to be highest when the diagnosis of malignancy is recent. In the first three months after the diagnosis of cancer, the risk was 53 fold increased and declined thereafter.<sup>1</sup> Additional risk factors for DVT in malignancy patients are due to vascular stasis as a result of immobilization, obstruction or compression of the iliac or femoral veins from large abdominal or pelvic tumors & lengthy surgery, vascular wall injury due to surgery, implantation of venous catheters, hormone therapy, and hypercoagulability.<sup>5</sup>

The most common treatment of DVT and PE is the use of anticoagulants such as Heparin and Coumadin. Anticoagulants do not dissolve clots, they prolong clotting time and prevent new clots from forming. This allows the body's own lysing abilities to break down the existing clots. Heparin (unfractionated) is used in the acute setting and is administered IV. A bolus can be given to increase the amount of medication in the blood to a therapeutic level within a few minutes. Then, a continuous infusion is started. Low-molecular-weight heparins (LMWH) given s/c represent a significant advance over unfractionated heparin. Because LMWH produces more stable blood levels, patients do not

require frequent blood coagulation tests to monitor the drug's effect and help prevent excess bleeding. Warfarin Sodium is an oral medication that takes about 2-3 days to become therapeutic. It can be continued for several weeks to months depending on the nature of the thrombus. Heparin has been shown to decrease the risk of fatal PE by 75% and to reduce the risk of recurrent PE from 25% to 2%. Long-term therapy with warfarin reduces the incidence of documented DVT from 47% to 2%.<sup>6</sup> However, studies have shown that as many as 33% of patients develop a second PE while receiving adequate anticoagulation therapy. Increasing the dosages of heparin or coumadin can put a patient in danger of bleeding. Because the clotting time has been increased, people receiving anticoagulants will always be at a higher risk for bleeding anytime they get cut or are injured.

All our cases were already on LMWH but were taken up for surgery when INR was below 1.5. LMWH was recommenced in all the cases on the second post operative day.

Thrombolytic therapy breaks down or dissolves a thrombus. The drugs used are potent and act within minutes to hours to dissolve the existing clot. The goal of thrombolytic therapy is rapid clot lysis, which hastens reperfusion of lung tissue and prevents chronic complications of pulmonary embolism. Currently, three agents are approved by the FDA for PE thrombolysis: Streptokinase, 250,000 U over 30 minutes, then 100,000 U per hour for 24 hours; Urokinase, 4,400 U per kg over 10 minutes, then 4,400 U per kg per hour for 12 or 24 hours; r-tPA recombinant tissue plasminogen activator 100,000 mg over 2 hours. The major complication of thrombolytic therapy is bleeding and this may be fatal and hemodynamic instability is the only absolute indication at the present time. This therapy may be indicated to lyse a clot that is entrapped in the filter and is causing significant caval obstruction. In none of our cases was thrombolytic therapy required in the post operative period.

Options for the prevention of pulmonary embolism are the use of vena cava filters for caval interruption. Techniques have progressed from extraluminal procedures for vein interruption using plication<sup>7</sup> and clips<sup>8</sup> to the creation of intraluminal filters.<sup>9</sup> Over the last few years, a consensus has been building up in the literature for the indication of the implantation of an inferior vena cava filter in cases in which anticoagulation treatment is contraindicated, or for patients who had pulmonary thromboembolism during full anticoagulation treatment.<sup>10</sup> Recently, with the development of newer endovascular materials and techniques, there has been an even greater willingness to indicate this procedure.<sup>11</sup> Some authors, such as Cohen<sup>12</sup> and Calligaro,<sup>13</sup> have proposed implantation of such filters as the first-choice method for oncological patients with DVT. Such proposals

have also been based on studies that have demonstrated that these patients are at greater risk of hemorrhagic events than nononcological patients.<sup>14,15</sup> The blocking of the inferior vena cava using an intraluminal filter was successfully performed in all the patients. Nine Titanium Greenfield filters & one Simon Nitinol filters were placed without any complications. The latter is useful when the distance between renal vein and iliac bifurcation is less.

The complications due to the technique are tilting/malposition/ migration of the filter; fracture of one of the struts and inferior venacaval wall penetration by guide wire, sheath-dilator complex, filter carrier system or filter. Caval thrombosis can occur months to years after placement. Most of the above complications were associated with the initial Mobin-Uddin umbrella filter. Ever since the introduction of the Green type of filters and their subsequent analogues there were no minor or major complications, and this is in keeping with the findings from other published series.<sup>16,17</sup> There is no consensus in the literature regarding which route is most suitable for implanting the vena cava filter. Some authors have advocated puncture of the femoral vein,<sup>18</sup> while others have preferred puncture of the internal jugular vein.<sup>19</sup> All our patients had the filter inserted via the femoral vein & none had any complications during the insertion. IVC filters are typically placed infrarenally to trap thrombi arising from lower extremities avoiding potential occlusion of the renal veins. Suprarenal indications are caval thrombus, source of embolus is renal vein or collateralised ovarian vein. Superior vena caval filters are placed for management of upper extremity thrombosis.

All patients with permanent filters have necessarily to be on continued anticoagulation therapy and have to be monitored for the same. IVC filter placement has been shown to be safe, with only a few relative contraindications in patients such as those receiving therapeutic anticoagulants, patients with thrombus between the venous access site and expected deployment site, and patients expected to undergo MRI after filter placement. Many of these contraindications have been addressed with changes in technique and the type of filter used. With smaller introduction and deployment systems and with the availability of ultrasonographic guidance during venous puncture, the reversal of anticoagulation often is not necessary. The presence of thrombus between the puncture and deployment sites requires the selection of a filter that allows an alternate approach (ie, brachial or jugular vein). The titanium Greenfield, Vena Tech-LGM, Vena-Tech LP, Simon nitinol, TrapEase, OptEase, Gunther Tulip, are nonferromagnetic; therefore, subsequent placement of the patients with these filters into the magnetic field during MRI is possible.

The aforesaid filters are permanent. Temporary filters (Anthe, Gunther) are used if thrombolysis is being carried. They are connected to the outside via a catheter or sheath and must be removed within about 10 days of insertion to avoid endothelialisation of the filter. Retrievable filters (Gunther, Tulip) are designed so that they can be removed within about 10 days via a right internal jugular approach by snaring a hook at the top of the filter. If necessary these filters can be left safely in situ as permanent.

In our experience therefore patients of cancer particularly of the pelvic region with recent evidence of DVT and on anticoagulants and in whom surgery is contemplated it is wise to have IVC filter implanted prior to surgery. The cost of IVC filter placement is approx. Rs. 50,000/-; the cost of filter alone being Rs. 25,000/-. There is no defined standard for following up patients with implanted vena cava filters. Such a follow-up can be performed clinically, or with the aid of imaging examinations.

#### CONCLUSION

Considering the high incidence of thrombo-embolism in cancer patients and that patients with DVT are at very high risk for fatal pulmonary embolism in the perioperative period; this therapy is advisable prior to performance of surgery despite the necessity of continued anticoagulation therapy.

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